

POPULAR SCIENCE

MONTHLY

JANUARY

NOW
15¢



See Page 57

NEW INVENTIONS

MECHANICS

THE HOME WORKSHOP

MONEY MAKING IDEAS

450 PICTURES

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WILLIAMS
57



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SOCONY-VACUUM OIL COMPANY, INC.



How Movies of Noise Gave Cars a "Hushed" Ride

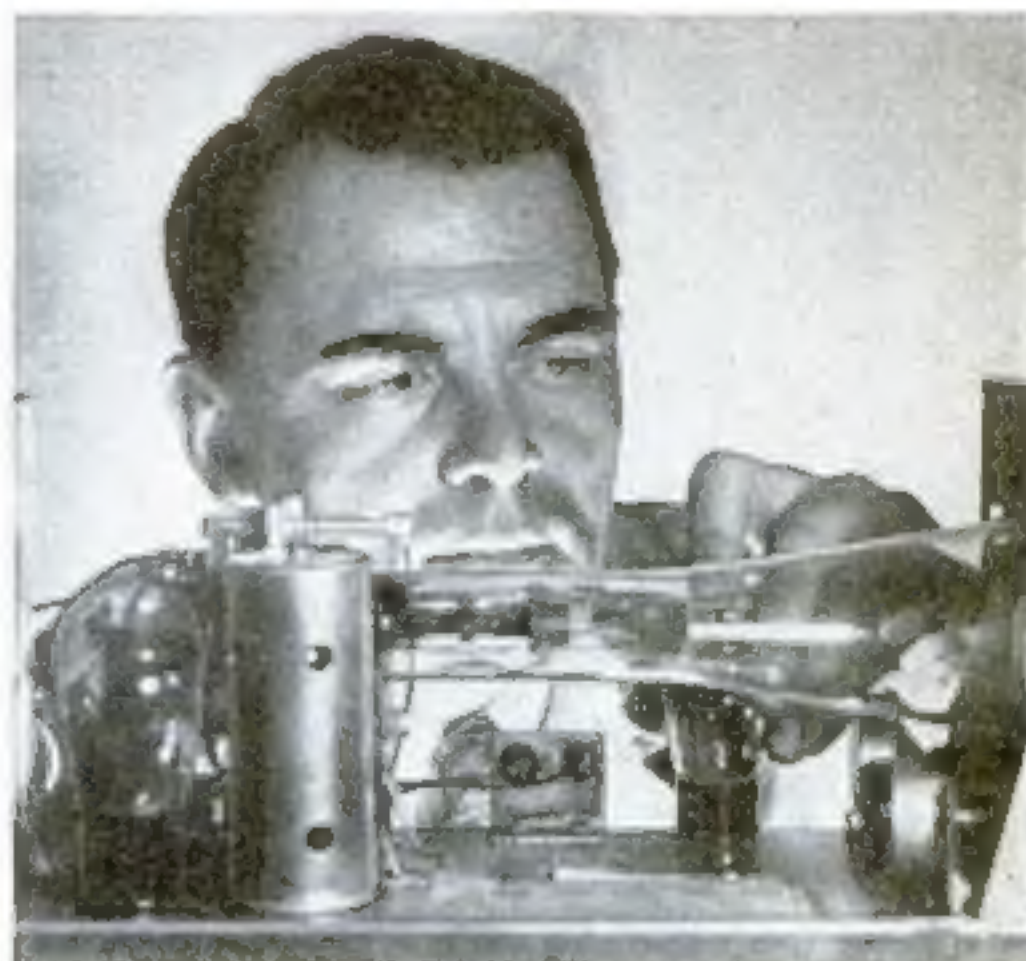
REMEMBER the clatter of old-time "gas-buggies"? In today's Plymouth you can hear a watch tick! And it's priced with the lowest...with the Commercial Credit Company's easy terms offered by Dodge, De Soto and Chrysler dealers.



1 This is One Way to plug out noise. But Plymouth contains special insulating materials which effectively keep noise out...give a "hushed" ride!



2 Different Parts of a Car have different vibrations. So Plymouth engineers put microphones everywhere inside... to ferret out the slightest noise.



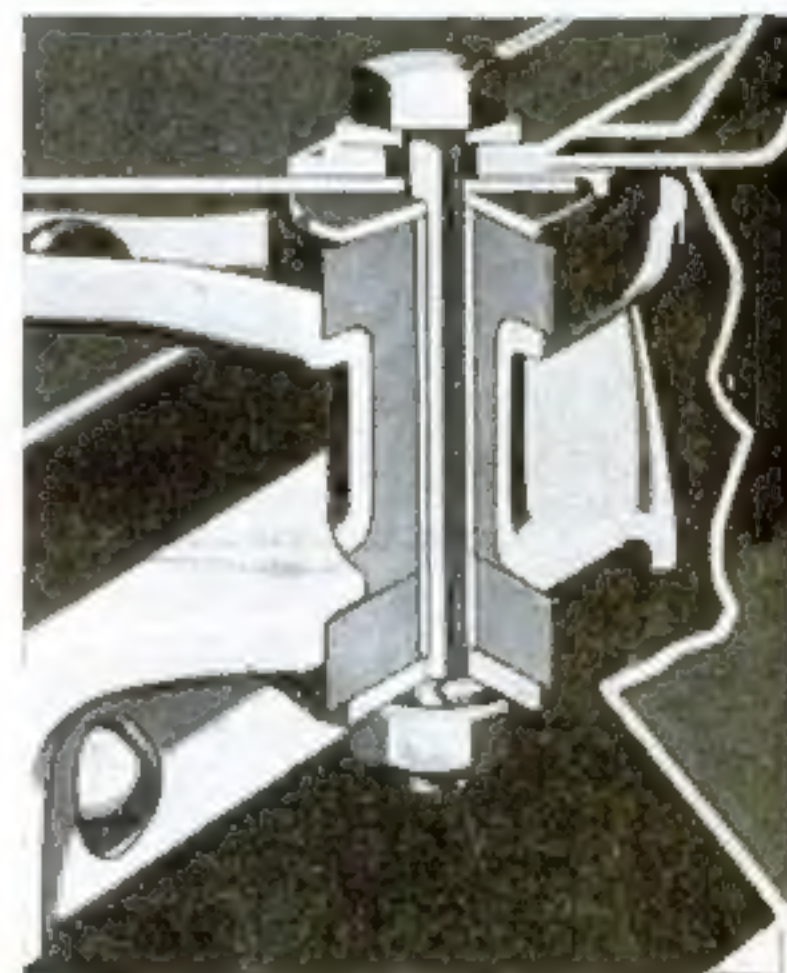
3 They Used Television tubes to photograph noise and transform it into light-rays. Throw these light-rays on a movie-film—and noise will paint its own picture for you.



4 This is a Movie of Noise. Look at the wavering sound-track on the film. Plymouth engineers studied hundreds of these "movies." They worked out 5 different ways to stop noise.



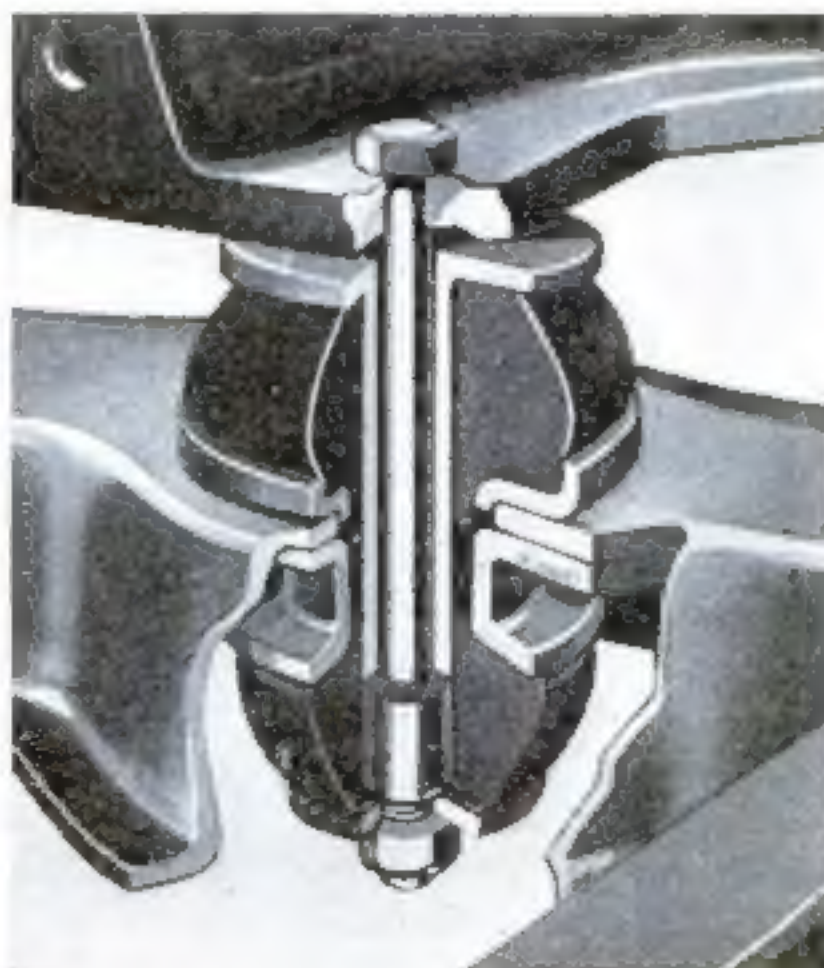
5 Dampens Hum, Rumble. When you grab an alarm-clock bell, the vibration is "dampened." A special material dampens vibration in various Plymouth parts.



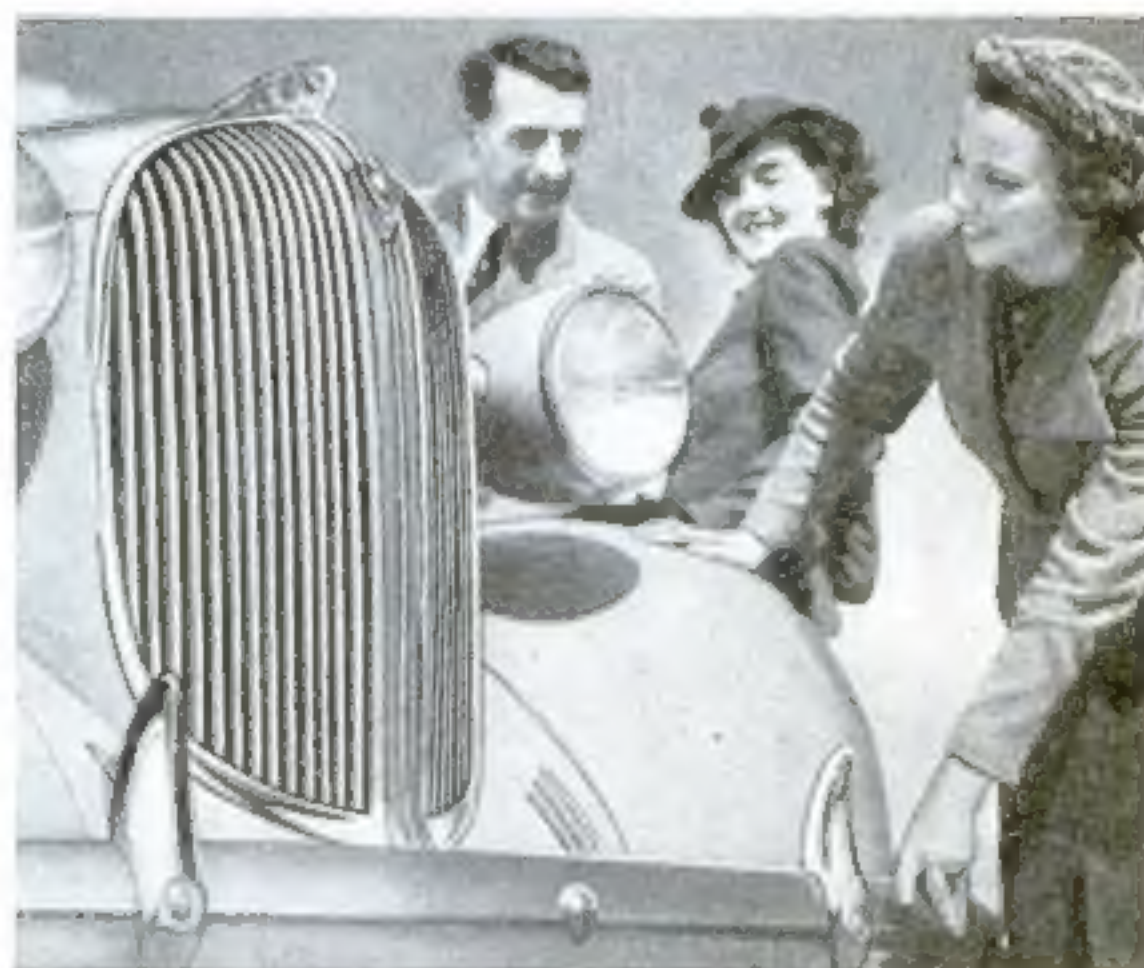
6 Blocking Road Vibration. Spools of rubber "float" Plymouth's body on the frame...efficiently block out road vibration.



7 Soaking Up Noise from the Air. Insulating materials are tested in this tunnel. Noise must be actually "soaked up" by these materials.



8 Patented Floating Power engine mountings keep power vibration from being telegraphed through the car's frame to the body.



9 The Big 1938 Plymouth! See it today—and learn the whole great story! PLYMOUTH DIVISION OF CHRYSLER CORPORATION, Detroit, Michigan. Major Bowes' Amateur Hour, C.B.S. Network, Thurs., 9-10 p.m., E.S.T.

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Plymouth Builds Great Cars

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CONTENTS for JANUARY 1938

How Good Are the New War Machines?..... Arthur Grahame 25

Military experts watch eagerly as modern weapons are tried in test-tube conflicts

Your Child's Portrait in a Doll..... 28

A new art creates amazing likenesses of real persons

What Are Your Chances?..... E. W. Murtfeldt 34

Mathematicians compute the odds on anything from craps to matrimony

Preserving the World's Largest Gorilla..... 38

Sculpture and taxidermy combined to make a jungle giant live again

Mineral-Water Gushers Produce Strange Boom..... Edwin Teale 42

An accidental discovery brings sudden wealth to a New Jersey community

Trailer School Teaches Driving and Housekeeping..... 48

A unique two-weeks course prepares travelers for the open road

Putting a Fairy Tale on the Screen..... Andrew R. Boone 50

First full-length cartoon movie presents "Snow White and the Seven Dwarfs"

Amateur Scientist Uses Homemade Instruments. Sterling Gleason 58

A visit to an unusual back-yard weather and earthquake observatory



Evolution of a homemade microscope built by an amateur scientist. Read on page 58 about his odd observatory

FEATURES AND DEPARTMENTS

OUR READERS SAY—	6
NEW IDEAS FOR HOME OWNERS	16
THE MAN WITH THE NET	33
QUESTION BEE	60
UN-NATURAL HISTORY	61
IS THERE A REAL GUS WILSON?	64
THE HOME WORKSHOP	65
IDEAS FOR MOTORISTS	93
HOOK A CAMERA TO YOUR MICROSCOPE	94
TABLE-TOP EXPERIMENT SHOWS WHAT CAUSES EARTHQUAKES	96
THRILLING STUNTS WITH A GLASS-EATING CHEMICAL	98
ALL-WAVE ELECTRIC RADIO USES TWO METAL TUBES	101
TIMELY HINTS FOR RADIO FANS	104

COVER DESIGN BY EDGAR F. WITTMACK

AUTOMOBILES

Snowplow Fastens to Car	31
Hospital in a Trailer	46
New Highways Save Gas	47
Words Replace License Numbers	56

AVIATION

Plane Boosts Transport Aloft	30
Power Boats Police Seadrome	32
Channel Crossing by 'Chute	54

MODELS

Model of Mystery Plane	78
Flintlock Pistol Model	82
Tender for Locomotive Model	86
Ship-Model Stanchions	88
Electric-Pencil Decorations	113
Holding Parts for Painting	124

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be doing - ONE
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Will you be struggling along in the same old job at the same old salary — worried about the future — never able to make both ends meet?

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Don't do it, man — don't do it.

There is no greater tragedy in the world than that of a man who stays in the rut all his life, when with just a little effort he could advance.

Make up your mind today that you're going to train yourself to do some one thing well. Choose the work you like best in the list below, mark an X beside it, and, without cost or obligation, at least get the full story of what the I. C. S. can do for you.

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☐ Patternmaker
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City.....State.....Present Position.....

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NEW DEVICES FOR THE HOME

Handy Basket for Laundry.....	62
Novel Egg Opener.....	62
Roller Improves Strainer.....	62
Double Waffle Iron.....	62
Ice Frozen in Cups.....	62
Bowl Dispenses Sugar.....	63
Jar Opener and Sealer.....	63
Automatic Washing Machine.....	63
Nutcracker Like Pincers.....	63
Mold Cooks Three Doughnuts.....	63
New Fruit-Juice Extractor.....	63

NEW PROCESSES AND INVENTIONS

Tool Removes Lamp Globes.....	30
Paper Strips Nourish Plants.....	30
Measures Static Electricity.....	30
New Light-Polarizing Paint.....	31
Baton Has Faint Glow.....	31
Compact Make-Up Kit.....	32
Skis Form Toboggan for Rescue....	32
Sanitary Bubble-Blowing Gun.....	33
World Globes Stay Up-to-Date....	44
Light Built into Screw Driver.....	44
Wheelbarrow Carries Pumper.....	46
Air Jet Aids Rock Drilling.....	47
Double-Purpose Shoe Brush.....	47
Watch and Clock Combined.....	47
Croquet Set of Rubber.....	47
Magnets Record Sound on Tape..	53
Desk Well Licks Stamps.....	53
Telescope Makes Solar Movies....	53
Air View of Mason-Dixon Line.....	54
Bottles Stack to Save Space.....	54
Process Waterproofs Cloth.....	55
Typewriter Fits Brief Case.....	55
Safety Ash Tray Catches Butt.....	55
Electric-Eye Flour Grader.....	56
Test Waterproof Typewriter.....	57
Craft Skims over Water or Ice....	57
Gas Mask Carries Light.....	57
Cotter Pin Locks Itself.....	57

PHOTOGRAPHY

Power Plant in Photo Truck.....	56
Timer from Old Alarm Clock.....	106

All-Purpose Camera Stand.....	106
How to Load Bulk Film.....	108
Nonjarring Shutter Release.....	125
Filing Small Negatives.....	125
Lens Shifted for Close-Ups.....	129

UNUSUAL FACTS AND IDEAS

Cream Mimics Silk Stockings.....	30
Fireflies Fight Snails.....	31
Amplify Patient's Head Noises....	31
Chain Has 350-Pound Links.....	32
Ice Causes Lights on Mars.....	32
Climbers Give Alpine Concert....	33
Twins' Fingerprints Differ.....	33
Test Warships in Model Sea.....	36
Green Make-Up for Television.....	44
Odd Bicycle Made from Bed.....	44
Torpedo Traced by Smoke.....	44
Test Turbines as Fish Killers.....	45
Fire Has Burned 147 Years.....	45
Germans Try Out Mystery Gun..	45
New Kind of Football Game.....	46
Take Germ Census of Phones.....	46
Test Gas Mask for Babies.....	46
Cemeteries Get Music System....	47
Smoke Matches Gowns.....	54
Toy Tank Trains Army Gunners....	54
Shoes Get Velvet Soles.....	55
Alkali Lake Tests Concrete.....	55
Dangles from Tower by Toes.....	56
Cigarette Holder for Nudists.....	56
Measures Athletes' Horsepower..	57
Home Tests of Science Laws.....	100

CRAFTWORK

Making Laughable Lamps.....	65
Gravity Cigarette Dispenser.....	84
Plaque from Bread Board.....	84
Old Cowhan' Necktie Rack.....	85
Jig-Sawed Folding Stand.....	85

WOODWORKING

Folding Drafting Table.....	72
Three-Drawer Silver Chest.....	73
Turned Flowerpot Stand.....	73
Walnut Rose-Petal Urn.....	80

IDEAS FOR THE HANDY MAN

Our Construction Kits.....	20
Sharpening Circular Saws.....	66
Fountain-Pen Letter Scale	67
"Ski Socks" Aid in Climbing.....	68
A Homemade Hygrometer.....	69
Test for Steady Hands.....	69
Alcove for Refrigerator.....	69
Silencer for Baby's Chair.....	69
Wrecking Bar Works Metal.....	69
Musical Door Chime.....	70
Storing Christmas Bulbs.....	71
Marble Game for Children.....	74
Heating Aid for Soldering.....	74
Magnets Hold Welding Work....	74
Float Valve for Furnace Pan.....	74
Portable Punching-Bag Stand.....	75
Salvaging Broken Stemware.....	75
Throwing the "Snow Snake".....	76
Jig-Sawing Small Work.....	76
Sponge-Rubber Sanding Block.....	76
Modernized Kitchen Cabinet.....	77
Homeworkshop Guild News.....	81
Painting Small Greenhouses.....	83
Snug Harbor for Skaters.....	87
Sandpapering Small Grooves.....	87
Candy Makes Shooting Target....	87
Collapsible Towel Rack.....	87
Hub Cap Ladles Sulphur.....	88
Soldering Iron Presses Ties.....	88
Socket-Wrench Screw Driver.....	88
Cardboard Display Easel.....	88
Wood Carver's Depth Gauge.....	88
Piercing Punches and Dies.....	89
Curved Jaws for Bench Vise.....	90
Attaching Key to Drill.....	90
Pie Trimmer Cleans Up Putty.....	90
Making an Indexing Head.....	91
Collet Holders Speed Jobs.....	91
Improved Shop Trestles.....	91
Hinged-Handle Tap Wrench.....	91
Making Low-Cost Crucibles.....	92
Home Workshop Blueprints.....	110
Old Bill Says—.....	123
Improving a Stepladder.....	124

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More people can talk with you. You can talk with more people.

Bell telephone service now gives you more value than ever.

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Our Readers Say



Can an Electric Eye See a Ghost?

THE other day I read in a newspaper about an old house in England that apparently has a bad case of "hants." Mysterious noises are heard, and objects are moved about in rooms that are closed and locked. Now scientists are laying traps for the alleged ghost or ghosts, with flashlight bulbs and cameras to be set off by electric eyes. What I want to know is, would a ghost walking across the beam of light in the electric-eye set-up have any effect? The ones you see in the movies seem to be semitransparent. Also, would the light from a photo-flash bulb light up a specter, or just shine through him? Down here in the South, the Negroes have a tradition that you can't shoot a ghost unless you use a silver bullet. Maybe those British scientists need some special equipment if they're going to get anywhere.—J.C., Charleston, S. C.



Finds Caustic Soda Is the Solution

ONE OF YOUR readers asks how to remove stains from flasks and other glassware used in the chemistry laboratory. I recently hit upon an idea that worked out with great success. I put some sodium hydroxide in a very dirty flask. I boiled the solution in the flask for several minutes. The result was amazing. Not only did the caustic soda remove all stains and residue left from a previous experiment, but it cleaned the glass so thoroughly that all I had to do when the flask cooled was to dry it with a cloth after rinsing it once. I hope this will be of some use to the perplexed amateur who wrote to you. I realize there are some stubborn residues that require sterner treatment, but I found this works in most cases.—R.B., Vancouver, B. C.

That Archery Article Hit the Bullseye

SINCE I think archery is one of the best hobbies or sports of all, I was especially pleased to see the pictures and account of the fifty-seventh tournament of the National Archery Association at Lancaster, Pa. There are many of us who are not able to go to the nationals, so we appreciate seeing pictures of our fellows who do attend. Archery is more than just a fad. It is closely wound up with the history of man, for whom it provided food and protection for many long centuries. I hope that you will have more on the subject of archery in the future.—F.A., Jr., Lebanon, Ind.



He'd Make Dirtless Farming Yield Two Crops for One

MAY I second the idea of N.J.R., of Pawtucket, R. I., requesting an article on "dirtless farming," giving chemicals used, the amounts and rate of application, and notes on the construction of a cabinet in which to grow the plants. The method could be very useful. Thus, during the winter months, plants could be grown in the cabinet, and during the summer, the resulting seed could be sown. In this way one could do two years' work in one. Tree seedlings could also be raised in the cabinet, thus producing two-year-old trees in one year.—R.L.E., Kenaston, Saskatchewan.

The Only Trouble Is, It's Non-Refillable

QUITE an idea, that queer house with walls made of bottles laid in cement. However, I would like to suggest one improvement. Why not use full bottles? With their bottoms pointing outward, the bottles would have their necks protruding into the rooms of the house. Wherever you happened to be when you wanted a drink, you could go to work with corkscrew or bottle opener. Adjoining bottles could give the various ingredients for cocktails. Of course, the time would come when the walls were stripped bare—or drained dry—from attic to basement. Then it would be time to move into a new house—if you could.—K.B.B., Baltimore, Md.



Likes the New Placing of Our Specialty Articles

AN INNOVATION in your December issue pleased me very much. It was the placing of the chemistry, microscopy, radio, and science-experiment articles in the section of the magazine known as The Home Workshop. It seems to me that you have done wisely in placing this material among subjects akin to them in their appeal to hobbyists and home experimenters. At the same time, may I point out, the change has "cleaned up" the forward section of the magazine, which now gives the impression of having been written for a general group of readers, rather than a particular one. By the way, the diversity of the subjects of your feature articles in the forward half of the book is a source of never-ending amazement to me. How in the world do you think them all up? I sincerely hope that your latest innovation will "take" with other readers, and that you may see fit to continue it in the future. And one more thing while I'm at it, let's have more articles like the one on how to avoid the common cold.—A.N.O., Sheboygan, Wis.

Nobody Ever Will Make a Gentleman of Mars

YOUR fine article, "The Truth About Poison Gas," started me thinking about the inconsistency of all the talk we hear of "humane" warfare. Every new weapon that has appeared on the battlefield, since the wooden club gave way to the flint ax, has been denounced as inhuman and unsportsmanlike. The Roman legionaries turned up their Roman noses at the crude barbarians who used bows and arrows from a distance instead of standing up like men to be prodded with pig-stickers. After the Battle of Bunker Hill, the British officers raised a great hullabaloo because the Americans had picked off the redcoats with rifled guns; they should have done it politely with smoothbore muskets. After all, the purpose of war is to kill and destroy. The only humane war is the one that doesn't happen.—T.M., Kansas City, Mo.



Reader Throws Cold Water on Bathtub-Door Idea

ONE OF YOUR recent issues contained an article about a bathtub with a door in it. As far as preventing accidents is concerned, it is a very good device, but how many people would wait to get out of the tub before the water had drained away? Not many, I'd say. For one thing, when a person finishes taking a bath, the dirt stays on top of the water. But if he stays in the water until the tub is empty, the dirt stays on him. Furthermore, there's still nothing to prevent him from slipping on the cake of soap. Isn't that so?—N.C., Jr., Dubuque, Iowa.

Mysterious Light Has Him Dazzled

ALTHOUGH I am an amateur electrician, I got short-circuited trying to unravel this one which I saw on display in a store window. It had all the earmarks of a first-class hoax to the person who knows anything about electricity, yet it was a most convincing set-up. An ordinary electric bulb was suspended by a shoe lace tied to a glass rod. I ascertained these facts to my own satisfaction: The bulb was of filament type; there were no induced currents to activate the filament; there were no optical illusions; there were no wires concealed in the shoe lace, and there was no other element (Continued on page 8)



LEAN BACK, BROTHER, AND LEARN SOMETHING!

**That Easy Chair of Yours can Show You
One Reason why the 1938 Buick has
the Most Modern Chassis in the World**

WHEN an easy-chair maker wants to build in comfort, what kind of springs does he use?

Right the first time — *coil* springs! Because coil springs are softer — last longer — keep their temper and springiness.

For such good reasons the 1938 Buick now has big, stout springs of *coiled* steel on all four wheels.

And by replacing the usual type of rear springing with **TORQUE-FREE SPRINGING** we not only gain a far smoother ride, but more constant traction, less wheel slip, lighter unsprung weight and surer car handling.

Buick is the only car that has such rear springing, and here's why.

Coil springs are not easily applied to any car that drives through the springs. Only a car like Buick, transmitting power through a torque-tube, can get full benefit of this new and better suspension.



With your interest in mechanical things, you'll want to inspect this new springing carefully and see how much simpler, safer and better it really is. You'll also find a lot to interest you in the *principle* of Buick's new **DYNAFLASH** engine.

Why don't you drop in on the nearest Buick dealer? You'll find the 1938 Buick has as many important new features as a red-headed kid has freckles.



A GENERAL  MOTORS VALUE

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LOOK SUCCESSFUL—BE SUCCESSFUL!

■ A good, healthy coat of tan has a surprising effect on your appearance. Salesmen find their sales actually increase after they have acquired a real bronze tan! And you will become more popular, for women, too, admire that healthy outdoor look!

IMPROVES HEALTH AS WELL AS APPEARANCE!

■ Frequent exposure to the ultra-violet rays of the sun tones up the entire system, stimulates the body into energy and vitality, increases gland activity, builds up resistance to colds... and aids in clearing up many skin diseases.

4 TIMES AS POWERFUL AS SUMMER SUN!

■ You know what a glorious tan your skin would acquire if you could spend an hour every noon sun-bathing. The Health Ray Sun Lamp has been tested by the well known Electrical Testing Laboratories of New York. Their report indicates that this inexpensive Sun Lamp gives the same amount of beneficial ultra-violet rays in 15 minutes in your home that you would get in one hour's exposure to the mid-summer sun!

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■ Build up resistance and vitality. Insure yourself against illness the sunshine way!



FULLY GUARANTEED! MAKE THIS FREE TEST!

Test this lamp at our expense NOW! Compact, easy to use, tested and approved... it is yours for 7 days FREE trial! This genuine carbon-arc lamp, fully guaranteed by The Health Ray Mfg. Co., Inc., Deep River, Conn., will be one of the greatest health investments you ever made.

SEND FOR DETAILS OF OUR 7-DAY FREE TRIAL!

Let us mail you our FREE book containing valuable information on sunshine, complete details of the Health Ray Lamp and our 7-day trial offer.

OR

If You Want YOUR SUN LAMP AT ONCE...

Simply mail \$1 with the coupon. Use it for 7 days. Then either pay \$6.95 balance or return the lamp and get your dollar back.

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151 Elm Street, Deep River, Conn.
(Check below for free literature or Sun Lamp)

☐ Send full details of FREE trial offer.

☐ Send Health Ray Lamp at once. I enclose \$1. In 7 days I will either pay \$6.95 or return the lamp and receive my dollar back.

Name

Please write Mr., Mrs., or Miss

Address

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Our Readers Say

(Continued from page 6)

than the lace running to the bulb. What I would like to know is how the bulb was lit.—J.Y., New York City.

He Wants Some Pointers on Divining Rods

CAN any of your readers tell me whether it is true that an underground stream of water can be located with a forked stick—and, if so, how it is done? I know a number of persons who firmly believe that they can take a forked limb of a peach tree, holding a prong in each hand, and it will turn downward against all their strength when they cross a stream of water.—E.C.O., Mobile, Ala.

HOKUS POKUS, HOPE
IT'S A JUG
O' CIDER!



It's Easy When You See It in Black and White

HERE'S my solution to the problem in deduction sent in by J.A.M., of London, England. Let us call the three men applying for the job as detective A, B, and C. There were five disks, three black and two white, and the object was to see which man would be first to figure out whether the disk on his own forehead was white or black. A came out first and said that his disk was black because the two others were black. As a matter of fact, if A had been just a little bit smarter, he could have known from the beginning that the manager would not use any white disks, since the appearance of a white one would result in a speedy piece of deduction on the part of one of the three men, in this way: Suppose C saw a white disk on A. He would know that his own must be black, because if it were white B would see the two whites on A and C and would conclude immediately that his own had to be black. Since C has not jumped for the door, A knows that his own disk is black. The manager must have enjoyed a hearty laugh with the winner when it was all over, because the winner could have guessed his disk would be black without even entering the room.—R.P.S., Troy, N. Y.

Wants to Sail His Models And Have Them, Too!

SOMETHING new—at least to me—would be an inexpensive radio remote-control unit for installation in model boats. Many model builders own midget gasoline engines as I do, but when it comes to putting them in boats to be turned loose, the risk of loss or destruction is too great. I would like to see you publish plans of this kind for a practical unit. I think other model makers will agree

YOU CAN STILL USE
GEARS 'ND CAMS 'ND
SUCH IN
YOUR
BOAT!



(Continued on page 9)

Wood Carving AND WHITTling



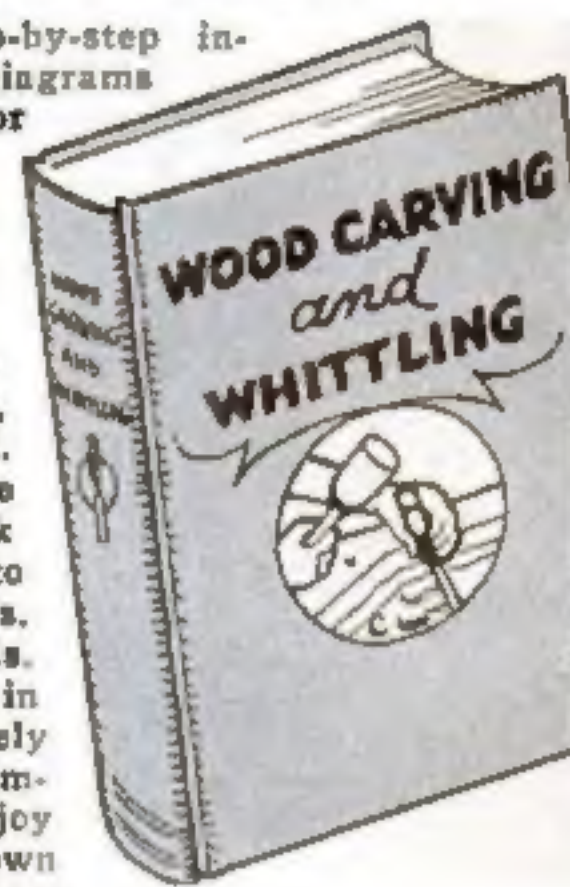
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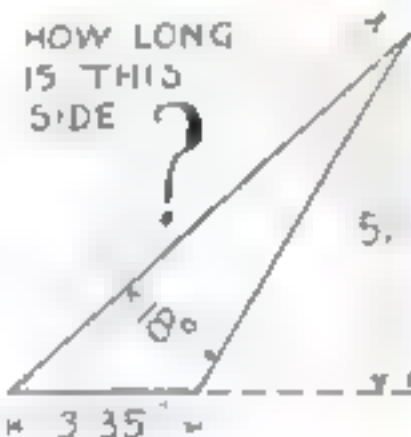
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that it would be great sport to start a model power boat skimming across a lake, and then be able, by means of remote control, to steer it at will, and finally guide it back to the starting point. Perhaps I'm asking too much, but I think such a control unit could be built inexpensively.—R.H.A., Cincinnati, Ohio.

REGARDING the question of A.P., of Youngstown, Ohio, I would like to say that many devices have been used for years to direct radio signals. They range from the highly complicated antenna arrays used by transatlantic telephone stations, down to the small, rotary "signal squirter," used by amateurs. As to the problem raised by H.A., of Long Beach, N. Y., about the system of transmitters and receivers talking back to one another, I think that the initial sound actuating either microphone would make the whole system break into an indignant howl of protest.—W.M., Perth Amboy, N.J.

AFTER fighting it out with the problem of J.J., Norwood, Mass., I found that the circular wall around the city was exactly nine miles in diameter, and the point of observation was fifteen miles from the house. And now may I offer another problem for the puzzle fans to knock out. An oblique triangle has a base of 335 inches, with the opposite angle of eighteen degrees. The altitude of the triangle is five inches. Find the length of the longest side of the triangle.—H.B.H., Philadelphia, Pa.



You are to be commended for the up-to-the-minute article in your December issue, "Steam Still Rules the Rails." However, I have long been under the impression that two difficulties limited the practicality of a super-locomotive, steam or electric, with the type of transmission gear planned for the new steam monster having multiple-cylinder motors on each set of drive wheels. The difficulties were: If the motor units were mounted on the locomotive frame, they would have to be connected to the wheels by the old-fashion, heavy connecting rods, because gears could not be made strong enough to absorb both the driving load and the pounding shocks of rail irregularities; and, if the motor units were mounted on the *axles* as "unsprung" weight, as in the design depicted in your article, the motor units and the rails would be subject to too great punishment from irregularities in the roadbed. I would like to know how these difficulties were overcome by the designers. Am I not correct in saying that the motors of giant electric locomotives now in use are coupled to the wheels by two sets of connecting rods, working at right angles through an intermediate crank, thus absorbing bumps that otherwise would harm gears, motors, and rails, by means of the familiar

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It is also the largest and most important nation in the world. The Radio and Television Corporation of India, or All India Radio, has 540 stations and a network of 50,000 miles of wires and cables. More than 60% of the population has a radio. More than 21 million have television sets. More than 4,000,000 automobiles are Radio equipped. Every year million of sets go out of date, are replaced with a new one. More than 100,000,000 sets are repaired each year. A few hundred \$45-\$50 a set can be made to last for 10 years. All Radio and a few television stations are owned by the Government.

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A Paramount Picture

(Continued from page 9)

"knee-action" principle? One more thing—I've often wondered why locomotive builders could not devise an endless-tread drive wheel to increase traction.—H.O.M., Hoboken, N. J.

Cabinetmaker Scorns Machine Jobs

As a cabinetmaker and furniture polisher, I have got many new ideas from your magazine. I wish you would publish more about cabinetmaking—things that can be made by hand and not by machines. The December article on how to use templates to improve wood turning jobs where several identical parts are needed was interesting, but an article on how to make similar pieces by hand would be better yet.—H. L., Brooklyn, N.Y.

THAT'S WHAT I HAVE
TWO GOOD HANDS
FOR!



It's a Free Country, This Reader Says

For several years I have endured the inane criticism of those amateur craftsmen and other readers of this magazine who have ideas for making changes in the various departments, cutting out articles of general interest, devoting each issue to one particular hobby, and so on. To those of us who prefer the magazine as it is, such changes would not be welcome. Those interested in only one subject can find magazines that specialize in those subjects and can give them more space than P.S.M. can do and still sell for fifteen cents. And as for the price, a single project or article often is worth more to me than the cost of several copies. You do not compel readers to buy this magazine, and no one is forced to read it against his wish. So, if they don't like it, why do they still buy it and then complain? Maybe they're just the chronic "kickers" who always think they could do the job better "if they only had the chance."—T.W.H., East St. Louis, Ill.

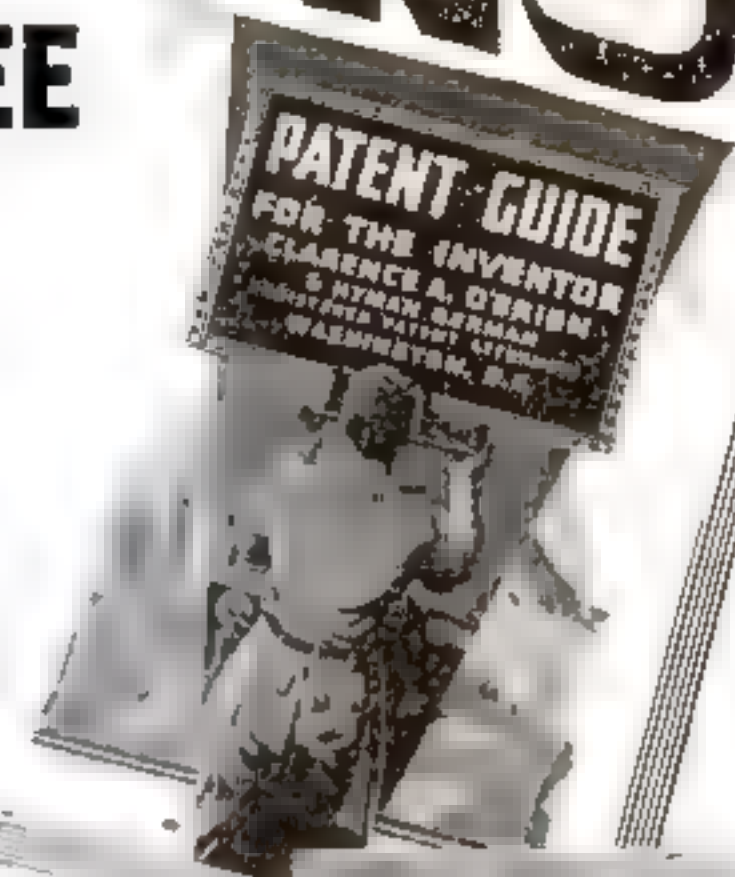
Space Ships and Whittling Are His Hobbies

YOUR magazine comes to me every month, even here "down under," as it has for many years. I go right through all the illustrations first, then read Un-Natural History. Next I turn to the microscopy article. I have made a couple of airplane models out of soft, solid wood, according to your plans, and they look very good on the sideboard. I would like to see an article describing the possibilities of future stratosphere and space travel. I think that in the end we will be making trips to other planets. Would you please run a few more words on whittling for us old-timers? It's an old game, but a useful one. From space ships to whittling seems like a long jump, but it so happens that they are my favorite mechanical interests. I hope to be still reading your magazine in 1947.—H.G.H., Melbourne, Australia.



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Secrets of Success

accounting seemed to offer better opportunities, so I took a course in cost accounting with the ——— School, which was of direct help to me in my work even before I completed it. Just when things seemed very promising, I was obliged to leave suddenly for the south, because of my wife's health. There, the knowledge of accounting I had gained from my course was a life-saver.

After two years as a bookkeeper and cost accountant with ——— Co., at Baton Rouge, La., I went into partnership with a local public accountant. In addition to making many installations of accounting systems in small business houses, I did a good deal of income tax work, with practically no knowledge of the subject. (A situation which seems to be prevalent to a surprising degree even today.)

One day I happened to hear of a Civil Service Examination for auditors with the Bureau of Internal Revenue at Washington. My familiarity with written tests, gained through my home study courses, helped me to pass with unexpected ease, and I was offered a \$3,000 position, which I gladly accepted, feeling that it would qualify me for much more important work later on.

In Washington I received a very valuable course of training from the Government, and also took a night course at the ——— School of Accountancy, receiving my B.C.S. degree at the end of the year. I was later sent out as a special representative of the Treasury, making examinations of extremely large groups of affiliated corporations.

Following the reduction of taxes under Andrew Mellon, and the general simplification of Federal corporate income taxes, I decided to return to general commercial work. I then completed a home study course in law, with the ——— School, and later passed my examination and received my degree as a Certified Public Accountant in Illinois, and subsequently obtained the same degree from the state of New York.

Until 1929, I made quite rapid strides, and although I suffered heavy losses during the depression, I managed to keep employed at a fair salary during every day of the entire time, besides keeping alive for two years a small public accounting practice in which I had associated another accountant with me.

Although my two degrees did not result in any very large income, yet without them I might have suffered far more than I did. When I think of what others went through during the depression, I thank God with all my heart for the relative good fortune with which I was blessed, and I sincerely believe that the various home study courses I have taken deserve a very large measure of credit for it.

After five years as tax accountant and consultant in the New York office of ——— Co., one of the largest national accounting firms, I was engaged



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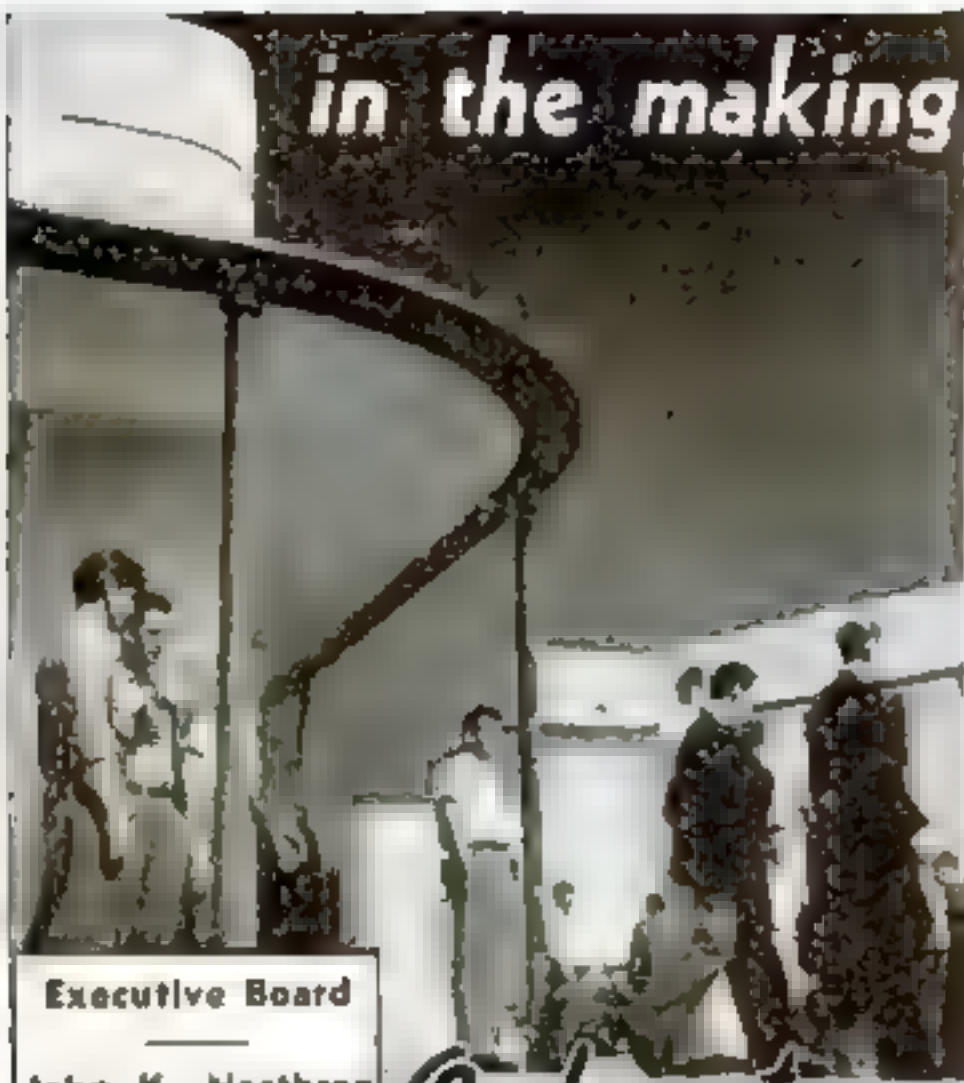
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P. D. S., New York City.

HOME STUDY A VITAL NEED

HOME STUDY has meant everything to me. I left school at the age of fourteen which is 36 years ago, as my folks could not afford to keep me in school. My father had met with an accident that had left him partly a cripple. I did not study any for a year and then I decided I wanted to get a future. So, being unable to go away to school, I decided I wanted to take up home study.

And I took a course in steam engineering in the _____ School of Correspondence, and after completing that I took one with the _____ School in electrical engineering. I did not earn any diplomas as I have transferred to different subjects, and in that way have saved myself expense.

On Feb. 15, 1937, I entered the employ of the _____ Company, as an electrician and still continued my studies as my hours were from two o'clock in the afternoon until midnight and I had plenty of time in the evening to study and made good use of it.

I held this position for six years and was then promoted to Foreman or Assistant Master Mechanic and held that position for twelve years.

And then the gentleman who held that position resigned and I was promoted to Master Mechanic which I held for five years until they merged their two plants. Their mechanic in their other plant was the oldest in service and they gave him the preference and made me his assistant at a very good salary, which position I still hold. Six months ago I was taken ill and have just recently returned to work.

About a year ago I became interested in Diesel engines and took a course at _____ School of Alton, Illinois.

I completed my full studies with this school and have my diploma.

They are contemplating Diesels at this plant and I wished to be prepared. I am a great believer of home studying, knowing what it has done for me, and if one will study as honestly and diligently as he would at school or under an instructor, he will make good.

If the student will be honest with himself, he can succeed. I am talking from my own experience, for it takes grit and energy to get anything in this life; and we all have it if we will only use it.

—A. A. M., Wauregan, Conn.

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Signal Stops Traffic for Boarding Trolley

TO INSURE the safety of passengers boarding street cars at night, a group of novel electrical installations have been made in Dearborn, Mich. As a prospective passenger waits for a trolley, he presses a button set into a curbside post. This causes an approaching street car to close an electrical circuit when it is 300 feet away. A light on the post near the passenger then turns red, halting automobile traffic, and an overhead floodlight illuminates a path from the curb to the car door. As the trolley proceeds on its way, a second contact switch turns off the lights.

Handy Landing Fields To Line Highways

SO THAT private plane operation may be encouraged and congestion at major airports relieved, aviation enthusiasts are now promoting a new-type landing field known as a "flight strip." Defined as an area from 200 to 800 feet wide, and up to 5,000 feet in length, the strips would be located adjacent to major highways and traffic arteries, at convenient intervals, to serve as a means of coordinating highway and air transportation. It is expected that the Massachusetts authorities may build several of the highway landing fields in the near future to test their practicability.

Gas Masks Eliminate Illness from X Rays

SICKNESS that often occurs among patients being given X-ray treatments, can be prevented by the use of gas masks, thus overcoming an important handicap to radiologists. Radiation sickness, they discovered, is caused by the electrically charged air inhaled by patients while the X-ray apparatus is in use. In ninety-eight out of 100 cases, special face masks that remove the electrical charges from the air successfully prevent the onset of the troublesome ailment, it is claimed.

Giant Spots on the Sun May Affect Humans

APPEARANCES of spots on the sun's surface have closely paralleled slumps in the price of securities on the New York Stock Exchange, according to comparative records kept by Dr. Harlan True Stetson, of the Massachusetts Institute of Technology. Dr. Stetson, who previously established the effect of sun spots on radio reception (P.S.M., Feb. '34, p. 11), believes that solar disturbances may in some mysterious way have a definite physiological as well as psychological effect on human beings. This, he suggests, might be due to the fact that sun spots are cyclonic storms in the sun's atmosphere, which are known to have a definite effect on magnetic conditions in the earth.

Neglect of Home-Study Training Cost This Man \$47,424!

How much are you paying to stay untrained?

SOME time ago we received a letter which every man working for a living ought to read—whether he's making \$20 a week or \$200. Here it is:

"During the forty years that I have been working, my salary has averaged less than twenty-four dollars per week with the exception of the last two years while I have been acting as foreman. I made good in this position and saw, through the failings of others, what would happen to me unless I found a way to train for larger responsibilities.

"I had read of home-study courses and began searching for one I thought would benefit me. I found it in the LaSalle Modern Foremanship course, and benefited by it, my salary being nearly doubled, and I was promoted from foreman to factory superintendent.

"This happened in a period of about ten months, and by devoting only about four or five hours per week to the training.

"I am now enrolled as a member of the Industrial Management course, and find the work very interesting and beneficial. It can be applied every day in the factory, and brings results.

"I regret that I put it off to so late a day in life to reap the benefits I am now enjoying, and can truthfully say to younger men that if they will only profit by the experience of others they can gain more knowledge through one year's training by LaSalle methods than can be obtained in ten years' practical experience by hard work."

We quote the above letter not because the man who wrote it is making a staggering salary as a result of his training, but because it illustrates so clearly the principle behind LaSalle training.

Here is a man who all his life had accepted the thought that he was compelled to work for little or nothing.

For one thousand, nine hundred and seventy-six weeks the writer of this letter paid at least \$24 a week for the doubtful privilege of staying in the ranks of untrained men.

Can anyone doubt that training would have doubled his salary just as easily when he was thirty-eight years younger—when he could attack his work with the abundant energy of a younger man?

Yet his neglect of this main avenue of progress cost him—leaving simple and compound interest out of the reckoning—the appalling sum of \$47,424—a fortune in itself.

If You Could Use \$47,424, Pause Before You Turn This Page

Perhaps you are already making quite as much as the writer of that letter—perhaps more. Perhaps, on that account, you may think that his experience does not apply to you.

But if training in Higher Accountancy—or Modern Salesmanship—or Business Management—or Law—or Business Correspondence—or any of a dozen other branches of business could change your forty-eight dollars into no more than \$72 a week (which is quite possible), and if you now NEGLECT to try to advance yourself through the training you need—will you not find it difficult, thirty-eight years from now, to explain to those who are dear to you why you threw away \$47,424?

* * *

Below this text there's a coupon. It will bring you not only full details of the training that appeals to you, but also a copy of that most inspiring book, "Ten Years' Promotion in One."

If you are sincere in your desire for advancement, you will not turn this page until you have clipped the coupon, filled it in, and by placing it in the nearest mail box placed yourself on the road to real success.



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You don't have to be an expert to make money in this fascinating field! You don't have to live amidst the whirl of exciting daily news events. You don't even need a special camera, or expensive equipment. It is NOT technical ability that publishers pay for. It's the knack of knowing WHAT to photograph, HOW to photograph it and WHERE to sell it that brings in the money! It's SALABLE and MARKETABLE pictures—full of human interest and popular appeal—that you must learn how to produce... not technically beautiful examples of photographic genius! Send for FREE BOOK which tells all about the simple training which quickly prepares you, right at home, to make the kind of pictures that SELL.

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Get your copy of "How to Make Money with Your Camera." Page 1 shows you the vast scope of the field. Page 7 tells the kind of snapshots that can bring you a good income. And on pages 12, 13, 14 and 15 are printed the pictures and letters of others who even 4 or 5 weeks after enrollment, are already making good money.

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That's what O. Hastings of Dorchester, Mass., earned while learning "how to take pictures that sell."

3 CHECKS IN 1 WEEK

York McClary, of Healdsburg, Ill., another of our members writes: "Received three checks this week I owe you a lot for starting me on this path."

New Tools and Materials for HOME BUILDING and REPAIRS



Driven onto the platform of this elevator, a car is lowered into an underground garage by an electric mechanism controlled by a button in the house doorway

Elevator Lowers Car to Underground Garage

AN ELEVATOR garage just developed is designed for homes in congested city areas where no space is available at the side or rear for a conventional garage. The car is driven from the street onto the lift installed in the front courtyard. Pressing a button

inside the house doorway starts the electric mechanism that lowers the car into a concrete-lined pit. Supported by tubular metal posts, the roof of the elevator settles to ground level as the car descends to its subterranean garage.

Curved Wall Board Aids Home Decorators

WALL BOARD manufactured in curved sections is now available for home use. Made in lengths up to eight feet, and in half circles having diameters of six, twelve, eighteen, or twenty-four inches, the panels are designed for use in conjunction with conventional flat wall board strips for finishing recreation rooms, attics, and other parts of the house with curved alcoves and corners. In the illustration at the right, two of the new curved sections have been combined with two straight panels in an installation providing a decorative corner treatment in a game room.



Enjoy One of the Best Jobs in Industry

Steady Work

As nearly all manufacturing—construction—building starts on the drafting table, the draftsman is one of the first to be hired and one of the last to be laid off. It is his blueprints, his specifications, that give the last word in what the workmen are to do. No article, building or construction job is started before the plans drawn by the draftsman have been officially approved.

Good Pay

The draftsman has been called the Junior Engineer which title just about describes his work, position and pay. He combines his knowledge of principles, mechanism and construction details with the ability to draw plans and indicate motions and methods on paper. On the average, his salary is considerably above the wages of the mechanic and, of course, less than that of the engineer.

Promotion

Developing plans, new machines or new construction methods—the draftsman works directly with important men of the organization. So he knows what is being considered and planned. It may be the superintendent—engineer—even the prospective buyer with whom he consults. These contacts, plus his experience and general knowledge of the business, place him in an excellent position for promotion when next there is a good opening.



Become a Draftsman

A Job Where You Are Not Old at 40

Athletes, farmers, and factory and shop workers who rely on muscle start growing old even before they reach 40 while office workers, executives, teachers, professional men—in fact, all kinds of brain-workers—are just approaching their prime at 40 to 50. Training increases your value AT ONCE and continues to help boost your earning power as you mature and as you increase your experience and background for forming judgments of your firm's policies and methods.

Security for Yourself and Family

Even if you now are only 18, 25 or 30, you should look ahead—begin training TODAY for the job you want at 50. Training helps you to be independent—self-supporting. It helps you to enjoy associations that are denied the untrained man. Training helps you to increase your earning power more QUICKLY—and by so doing to offer members of your family advantages far in excess of what you could give them as an untrained man. Train and enjoy PROGRESS—CONTENTMENT—INDEPENDENCE.

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2 Drafting Lessons Free

Test Yourself! See how easily you can learn to Draft. It is an interesting, practical, and useful work. Write TODAY for facts and 2 beginning lessons FREE!

Novel Speedboat Glides on a Cushion of Air

LITERALLY riding on a layer of compressed air, a new speedboat designed by Gar Wood, famous power-boat racer, is expected to eliminate skin friction between the boat and the water, the largest single factor in cutting down the speed of modern racing craft. Blowers geared to the engine will force com-

pressed air through channels in a tunnel running the entire length of the hull, so that at high speeds the boat will glide along on a cushion of air. Another feature of the novel craft is the position of its propeller, which is located in the bow instead of in the conventional position at the stern.

Cheese Now Packed in Special Tin Cans

PACKING cheese in sealed tin cans is made possible by the recent development of a container fitted with a one-way valve that lets gas escape but prevents air from entering. As described by Dr. L. A. Rogers of the U. S. Bureau of Dairy Industry, the valve will let out the gas formed during the fermenting of the cheese, a process which continues even while the package is on

a grocer's shelf prior to its sale to a consumer. At the same time, it is said, the valve will keep out mold and germ-carrying air. Previous attempts to use tin cans for cheese have failed because gas formed within the can caused it to swell out and finally, when interior pressure became strong enough, to burst its seams, rendering the cheese unmarketable.

Oil-Well Fires Put Out by Water-Cooled Bomb

RAGING FIRES resulting when oil wells blow out and burst into flame, may be quenched by a novel explosive fire extinguisher devised by Frank Lesh, of Casper, Wyo. Heretofore, the only known way to stem an oil-well blaze was to don an asbestos suit and rush a charge of nitroglycerin into the inferno

to blow it out. In Lesh's invention, a container is fitted with water-cooling apparatus to cool a high explosive inside. Pulled into position by a steel cable, without endangering firemen, the explosive is kept safe by the cooling system until an electric mechanism detonates it.

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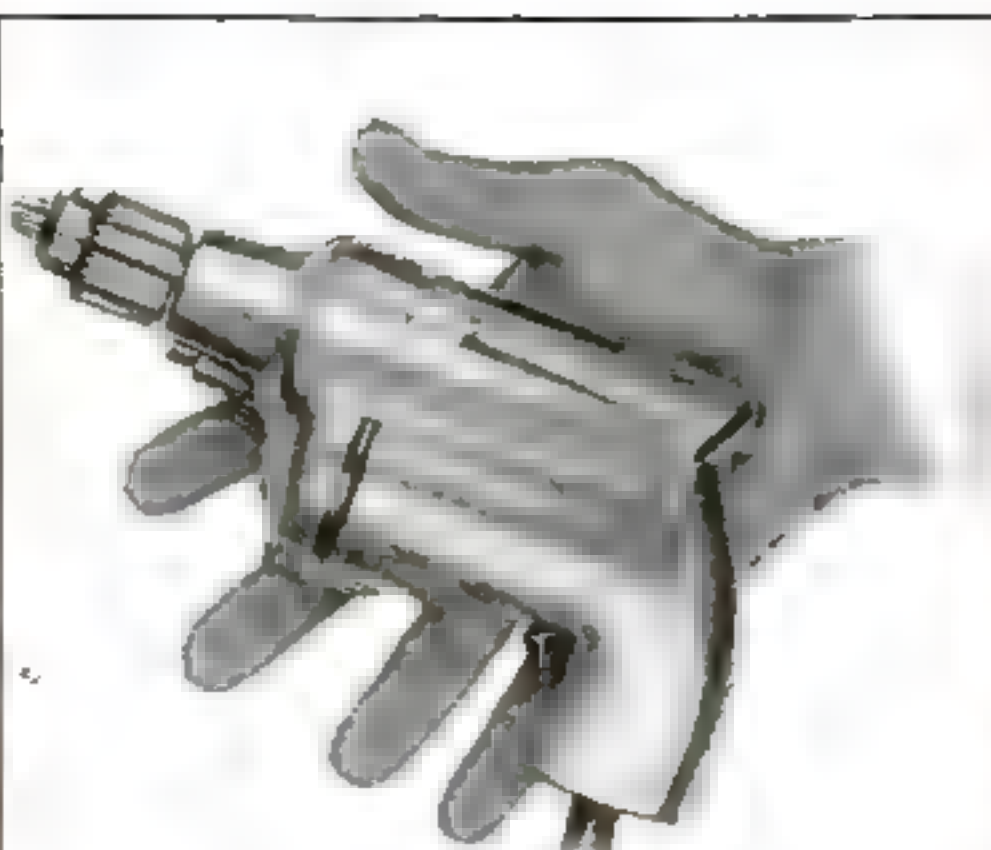
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Address.....
Attach letter stating age, occupation, employer's name and address and that of at least one business man as a reference.



N. W. School of Taxidermy, 3391 Elwood Bldg., Omaha, Nebr.



Midget Electric Drill Fits in Palm of Hand

ENCASED in a streamline housing a midget electric drill now on the market weighs only two and a half pounds. Eight inches in overall length and fitting easily into the palm, the diminutive tool drills quarter-inch holes in steel. It operates on A.C. or D.C. house circuits.

Spillproof Package Dispenses Tacks



TACKS cannot spill out of a new cardboard package. Lifting the lid uncovers a small opening through which tacks can be shaken one or more at a time, depending on the force used. Stop flanges cut into the folding cover of the novel container, prevent the lid from coming completely open, thus preventing accidental spilling of the contents.

Questions FROM HOME OWNERS

C. R., PORTLAND, ORE. A sure way to prevent the formation of rust on metal surfaces is to clean them thoroughly and coat them with a colorless linseed-oil varnish that will form an air-tight seal and protect the metal from the effects of oxidation.

Many Uses for Table Salt

P. R., KINGSTON, N. Y. Common table salt has a wide variety of uses about the home. It will remove egg stains on silver. Sprinkled on rugs and carpets before cleaning, salt will help to brighten them. A solution of salt in vinegar is excellent for cleaning brass.

(Continued on page 19)

CASH IN ON RADIO THIS EASY WAY

It's easy to be a success if you know how. Seize TODAY'S golden opportunity!—RADIO. Make \$5.00 to \$15.00 a WEEK, spare time; much bigger pay full time; or have your own business. I'm training hundreds at home with latest methods and REAL PROFESSIONAL EQUIPMENT. Easy to get started, easy terms. My FREE book shows how: Write me TODAY.
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Questions from Home Owners

(Continued from page 18)

while rust stains may be removed by rubbing on salt and lemon juice and then exposing them to direct sunlight to dry. Salt in the laundry water is an old-fashioned but a helpful method to prevent colors from running, and keeps clothes from freezing while they are drying on an outside line in cold weather. A pinch of salt added to cream helps when whipping it.

Removing Ceiling Spots

Q.—I HAVE tried painting over a stain on the ceiling of one of our rooms, but the spot still shows through. What can I do to remedy this?—G. H., Winston-Salem, N. C.

A.—BEFORE you paint over the ceiling spot, mix some unslaked lime with alcohol and wipe over the stain. As the mixture dries, the alcohol will evaporate, leaving a layer of lime over the spot. Then proceed with regular painting.

Producing Colored Flames

Q.—CAN YOU tell me some of the chemicals or compounds that will produce colored flames when scattered onto the logs in the fireplace?—B. D. O., Burlington, Vt.

A.—FOR a bluish-green flame, use copper chloride, copper sulphate or, better yet, copper ammonium chloride. Potassium permanganate produces a purple flame, while ordinary boric acid or barium chloride will form a green flame. Red colors can be obtained by using strontium nitrate or lithium chloride, although the latter is rather expensive. The chemicals can be wrapped in a transparent cellulose material for easy application, or you can dissolve them in water, using a pound of the chemical to two quarts of water. In that case, pine cones or plain blocks of wood can be soaked in the solutions, dried, and then thrown on the fire. Best results are obtained when the chemicals are applied directly to the bed of coals or embers.

Removing Rusted Screws

Q.—WHAT is the best way to remove screws rusted into their seats?—C. B. V., Davenport, Iowa.

A.—HEAT an iron poker red hot, and then hold it against the screw head. When sufficiently heated, the screw will probably turn easily. Expansion of the metal breaks the film of rust around the threads.

Economical Rug Pad

F. H., DULUTH, MINN. Heavy brown paper, of the kind used for wrapping, laid under rugs or carpets is useful as an economical substitute for a composition rug pad.

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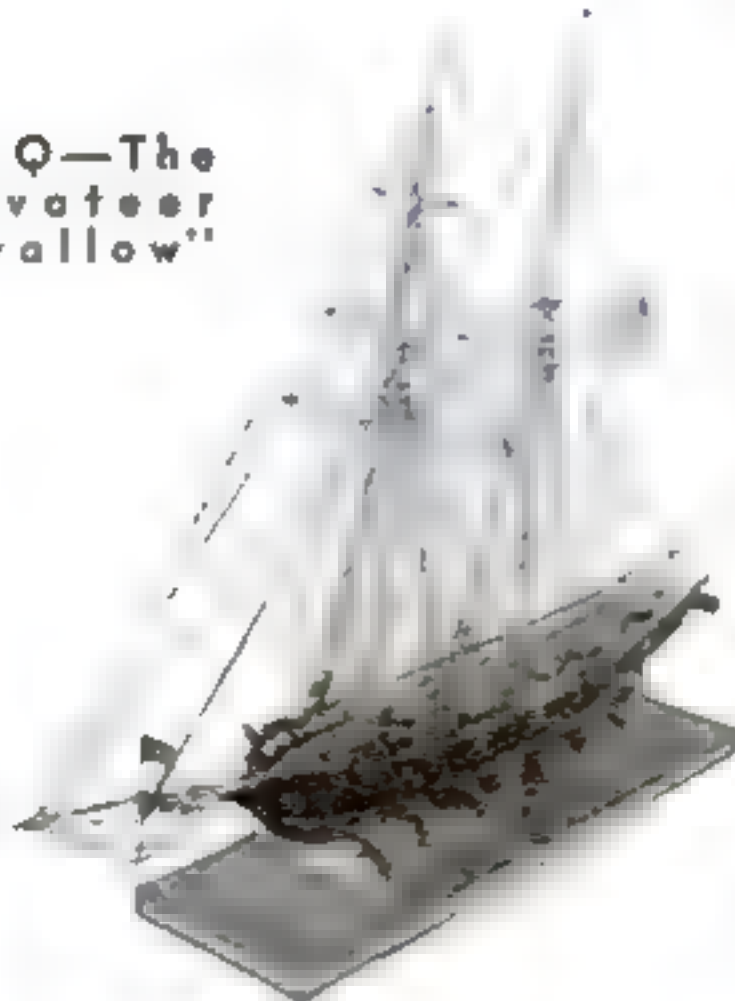
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(Continued on page 21)

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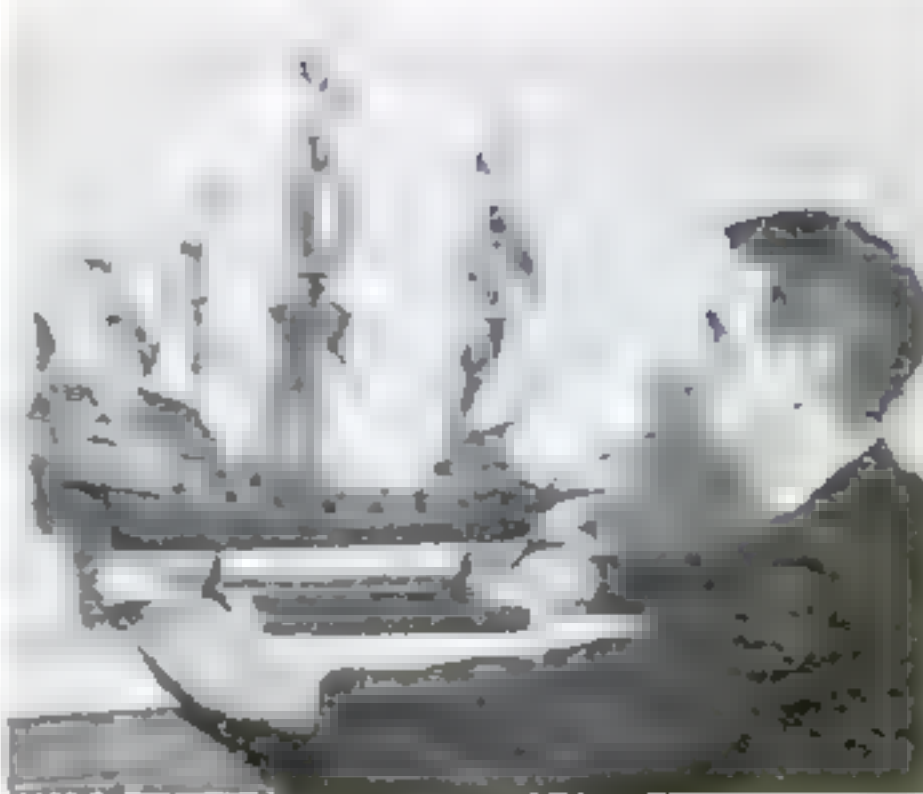
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Our Construction Kits

(Continued from page 20)

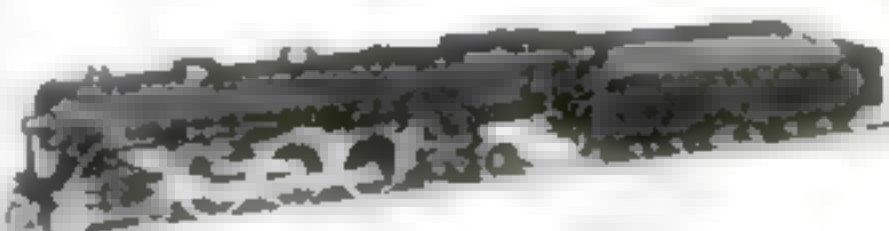


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- D. Spanish galleon, 24-in. hull, 30 in. over all. 6.95*
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- L. Farragut's flagship *Hartford*, steam-and-sail sloop-of-war, 33½-in. hull, 41 in. over all. 8.45*



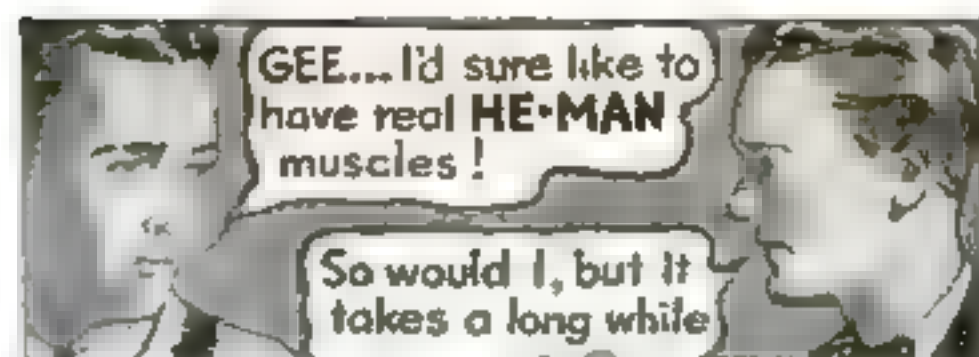
Kit 1L—HO-gauge locomotive model

- Q. Privateer *Swallow*, 12½-in hull, 20 in. over all. 4.95†
- V. Clipper *Sovereign of the Seas*, 20¼-in. hull, 26 in. over all. 4.95†
- Y. Trading schooner, 17½-in. hull. 4.90†
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- 3S. *Constitution* ("Old Ironsides"), 21-in. hull, 31 in. over all. 6.50*
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- 6S. Brig *Malek Adhel*, ¼-in. scale, 20-in. hull, 33 in. over all, frame-and-plank construction. 9.75†
- 8S. Fishing Schooner *Bluenose*, 17½-in. hull, 22 in. over all ... 4.95†
- 9S. Whaleboat, 14 in. long; partly shaped hull and raw materials for making all equipment. 2.75†

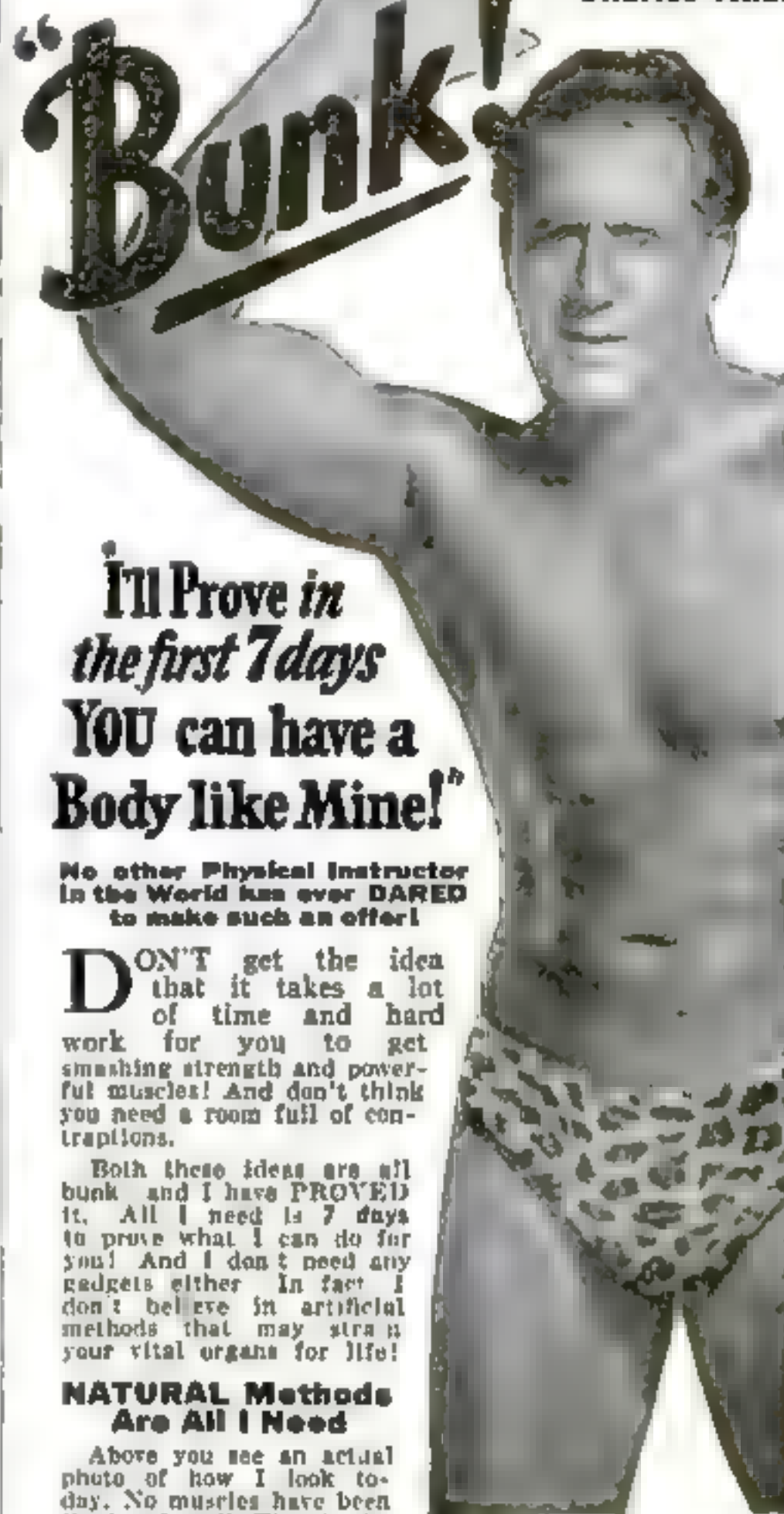
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(Continued on page 22)



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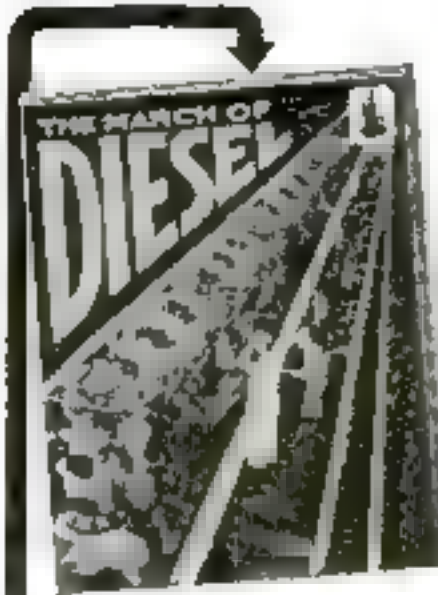
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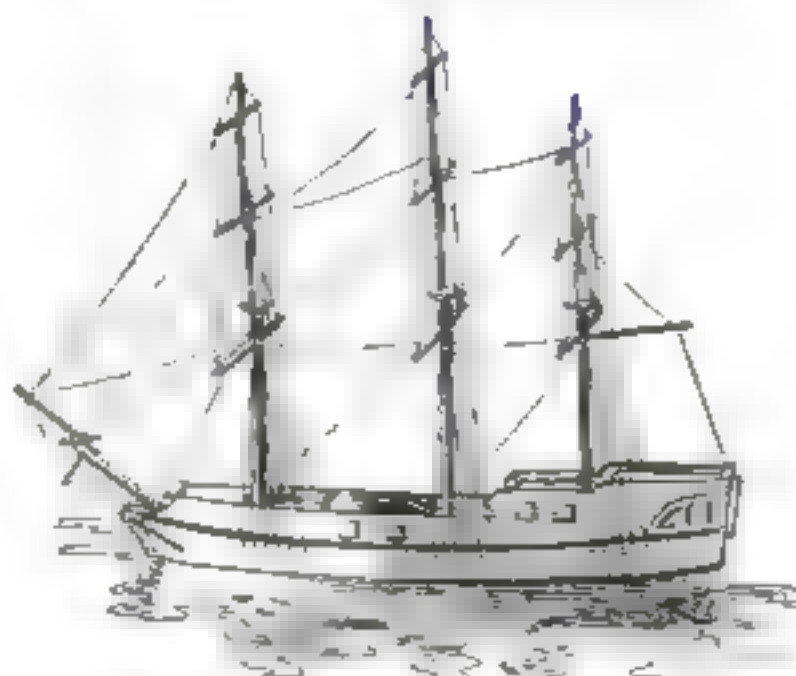
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(Continued from page 21)



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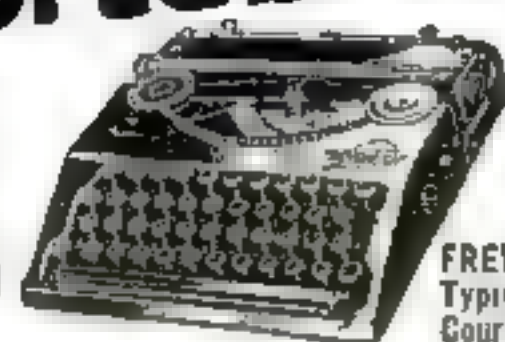
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Helicopter Flights Set New Records

ALL world records for flight in a helicopter—a type of aircraft that rises vertically under its own power—were reported broken not long ago by a German aviator named Rohls. He flew a craft of new design, driven by a single 160-horsepower motor and employing a pair of three-blade propellers on vertical hubs to sustain its airplane-like fuselage in the air. The machine attained an altitude of 8,202 feet, remained in the air one hour and twenty-one minutes, and maintained an average speed of seventy-six miles an hour over a course that was more than twelve miles in length.

It traveled ten miles nonstop in a straightaway line and fifty miles nonstop in a flight returning to the point of take-off. France previously held the world's altitude record of 518 feet, the duration record of one hour and three minutes in the air, the sustained-speed record of twenty-eight miles an hour, and the return-to-take-off distance record of twenty-seven miles, all established in November, 1936, by a Breguet-Dorand helicopter. A Fiat helicopter established for Italy the previous world's straight-line distance record of approximately one mile.

The remarkable extent by which some of the new marks surpass the older ones emphasizes recent progress in the design of helicopters. Many air experts envision craft of this type as playing an important role in the future of aviation—both for civil use in private flying, and for military use, where observation planes that could hover motionless in the air might replace captive balloons.

Gold Replaces Silver in Mirror Making

SILVERING mirrors may give way to "gilding" them as the result of an economical new method of depositing a backing of pure gold on glass. The British discoverer of the chemical process, Prof. Charles S. Gibson, recently exhibited a six-inch convex mirror successfully coated with only a fraction of a cent's worth of gold. The thickest of the coatings measures about one two-hundredth of the thickness of this page, while by varying the method it is possible to produce a film of gold so thin that it is transparent, and takes on a beautiful greenish blue color when light shines through it. Thickness of the gold is regulated by altering the conditions under which the process takes place, and the quantities of materials used. The golden backing is declared easier to produce, and more resistant to corrosive chemicals, than the conventional silver coating. While the process was developed primarily for scientific purposes, it appears to be perfectly applicable for producing decorative household mirrors as well.

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F I S H E R F A C T S

SEALING STEEL *for* SAFETY *in the* UNISTEEL BODY *by* FISHER

FISHER engineers are frequently asked: Where does the Unisteel Body differ from steel body building precedents? What is the chief difference between it and steel bodies of the past?

The answer is simple. Fisher engineers do not build an all-steel shell and then add the necessary braces and supports. In the Unisteel Body the outer steel panels, the inner steel structure and all steel reinforcements are fused into one single solid steel unit.

From the famous steel Turret Top to the heavy ribbed steel floor, the Unisteel Body is not only all steel—but all one weave-proof, shock-proof glorified steel structure with no semi-solid joints.

You can see what a difference this makes in the smooth, unbroken contours of its built-in beauty. You can feel the difference in the luxurious silence of its interior, even when the going's rough. For, as a matter of fact, the Unisteel Body is not only insulated against heat and cold—but against road rumbles, inside vibration and outside noises, too.

Remember these facts before you decide

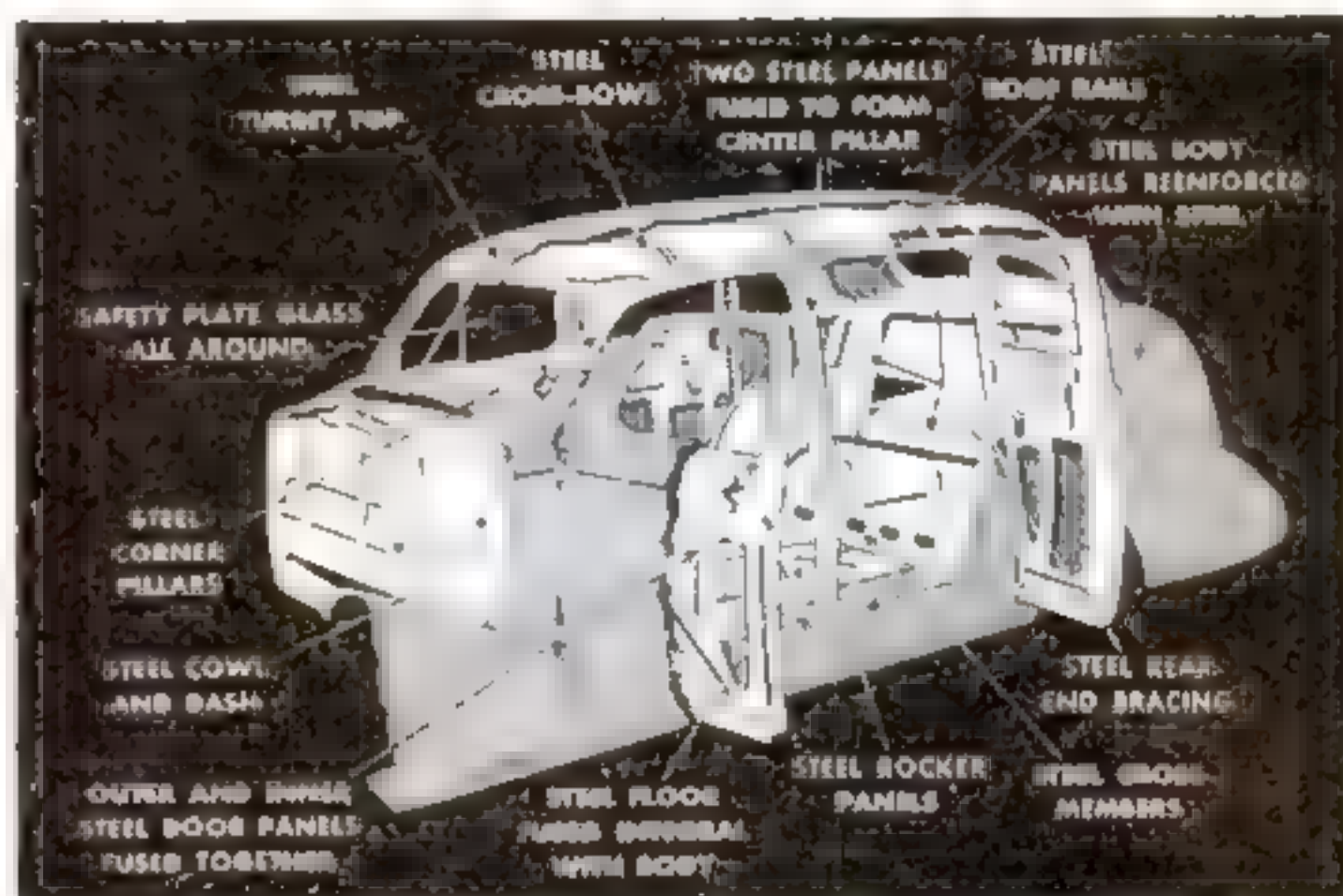
what your next car will be. Look first at the General Motors cars—the only cars with Unisteel Turret Top Body by Fisher.



Where steel meets steel in the Unisteel Body, it is solidly fused together—there are no weak links, no joints to loosen and rattle. When finished, the Unisteel Body is all one shock-proof, weave-proof unit.



YOU'LL BE AHEAD WITH A CHEVROLET—ahead in style, in comfort, in safety. For Chevrolet, "The Car That Is Complete," is the only car in its price class with Unisteel Turret Top Body by Fisher.



INSULATED AGAINST NOISE, HEAT AND COLD. Not only is the Unisteel Body shock-proof and weave-proof—it is a quiet body. The insulation keeps the interior quiet by muffling outside noises and absorbing all body and chassis noises. The insulation also helps to keep the interior warmer in winter, cooler in summer.



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HOW GOOD ARE THE NEW War Machines?

By ARTHUR GRAHAME

SINCE shortly after the World War ended, we have read and heard much about marvelous new weapons that were going to win "the next war" between major powers. We have been told that swarms of airplanes would bomb the world's greatest cities into piles of smoking ruins—or at least win the war before a soldier could march across a frontier, by pulverizing transportation arteries and destroying concentrations of troops and war materials. Monstrous land battleships would crush resistance beneath their ponderous tracks, while deadly little tanks would spin across-country so fast that there could

be no effective defense against them. Gases would suffocate and poison soldiers and noncombatants alike. Germs, death rays, and new explosives of terrific power would reduce the infantryman, who for centuries has ruled the battlefields of the world with his rifle and his bayonet, to the ignoble rôle of a mere mop-up after the devastating new machines of Mars.

For several years, the general staff of every first-class military power has been assailed with raucous advice from proponents of the various new weapons. "The next war will be won and lost in the air!" shouted the ardent disciples of the late General Giulio

Real air raids on modern cities have not fulfilled the dire predictions that alarmists had made of them

• Test-Tube Conflicts Put Latest Weapons on Trial •



This German tank came to grief in the proving ground of the Spanish civil war. Right, rebel soldiers examining a captured Russian machine



Douhet, Italy's prophet of air power. "Stop spending good money for cannon and rifles that the enemy won't give you a chance to use. The airplane is the only worth-while weapon, and the only defense against airplanes is more airplanes!" Other enthusiasts were as insistent that only tanks and armored cars could do anything useful against the machine gun and other modern defensive weapons. "Get rid of those useless horses—cavalry and horse-drawn guns are things of the past!" advised believers in motorization and mechanization. And scoffing chemists asked: "Why waste time and money on planes

and guns and tanks, when gas can do your work cheaper, and more thoroughly?"

GENERAL-STAFF officers, whatever uniform they wear, usually are realists who are somewhat on the conservative side. Most of them put their trust in the often-proved combat team of infantry and artillery. But no general staff can afford to give any other general staff a chance to get ahead of it, so they all experimented with the new weapons. They spent many millions of the taxpayers' dollars for them. They learned all they could about them from maneuvers and war games, but military operations are very much like football plays—almost anything will "go" on paper. It was only in the fiery crucible of real war that the value or lack of value of the new weapons could be determined.

When Italy's legions marched into Ethiopia, the military experts of the world found what they wanted—a test-tube war. When Spain exploded into murderous civil strife they found another and a better laboratory of battle. Italy, Germany, and Russia grasped the opportunity to try out their new war machines while they furthered their political aims. They sent planes, tanks, and other weapons of attack and defense, with trained men to use them,

to the rebels or to the loyalists. And when Japanese armies stormed into China in undeclared but ruthless war, the intently watching experts got still another chance to judge how important a part the new weapons are likely to play in the next struggle—if there ever is one—between powerful and evenly matched nations.

What the military experts have learned from this experimental warfare has been surprising to many of them, distinctly disappointing to the more rabid advocates of some of the most modern weapons, and considerably encouraging to nonmilitary persons who had seemed to be earmarked, either as fighters or as noncombatants, to be future victims of the new war machines.

The airplane is the new weapon whose performance has been watched with the keenest interest. Of course, war planes were used in the World War. But the aircraft of to-day fly something like three times as fast, more than twice as high, and at least ten times as far as did the planes of twenty years ago. New bomb-sighting devices have improved the marksmanship of airmen tremendously. In theory, at least, accurate bombing now is possible from any altitude from which the target may be seen.

No air force of the future can hope for quite so complete a push-over as the recent African war set up for the Italian airmen. The Ethiopians had no air force, and practically no ground defense against air attack. The Italians had complete mastery of the air without having to fight for it—an advantage



Can planes sink ships? Above is shown the damage done by bombs dropped on the liner "President Hoover" off Shanghai as at right





Although motor trucks for transporting troops are fine in theory, the Italian soldiers shown above in Ethiopia found they had to resort to mule packs in rough terrain

that no air force ever will have in a war between powerful nations.

And yet the air force played a distinctly minor rôle in winning the war for Italy. Planes, the Italians found, were very useful for long-range scouting, and in a few exceptional situations they were valuable as food carriers. They were moderately successful in bombing and machine-gun attacks on poorly disciplined and half-disorganized ground troops. Airplane bombing sometimes was used in preparing the way for an advance of the infantry, but it wasn't nearly so efficient for that purpose as an artillery barrage. Bombing attacks on towns killed a few hundred or a few thousand noncombatant natives, but they did little or nothing toward achieving the military decision.

WHEN the Spanish civil war started in mid-July of 1936, the Spanish Army had a couple of hundred airplanes, but they were of obsolete types, and they took little part in the confused fighting of the first few weeks of the struggle. But by early September, Gen-

eral Franco's rebel army had been supplied with skilled German military airmen flying Junkers bombers and Heinkel fighters, and equally good Italian aviators flying Savoia-Marchetti bombers and Fiat fighters. The loyalist forces had been reinforced by Russian flyers in planes that are almost exact duplicates of our Boeing bombers and Curtiss fighters.

The Russian aircraft proved to be superior to both the German and the Italian, but the rebels had by far the larger number of planes, and won control of the air.

When that happened, air-minded observers expected that the world would be given a tragic but impressive demonstration of what aircraft could do to an enemy city and its inhabitants. The callous cruelty of both armies had shown that non-combatants had no hope of mercy from fighters on the other side of the deadly Spanish family argument.

Rebel planes attacked Madrid with the avowed object of breaking the civilian population's "will to resist." Little bothered by the loyalists' feeble anti-aircraft batteries, they flew low and bombed viciously and persistently. Using from twenty to fifty planes, they attacked thirty times in less than two months. They killed hundreds—perhaps thousands—of defenseless noncombatants. But at the end of those two months of flying terror, the people of Madrid still were going about whatever business the war had left them, and they weren't begging for peace. Four of the city's movie theaters, which never had closed, were showing to good crowds every evening! Bravery isn't confined to men who *(Continued on page 184)*

Spanish loyalists carrying a modern machine gun and its ammunition into action



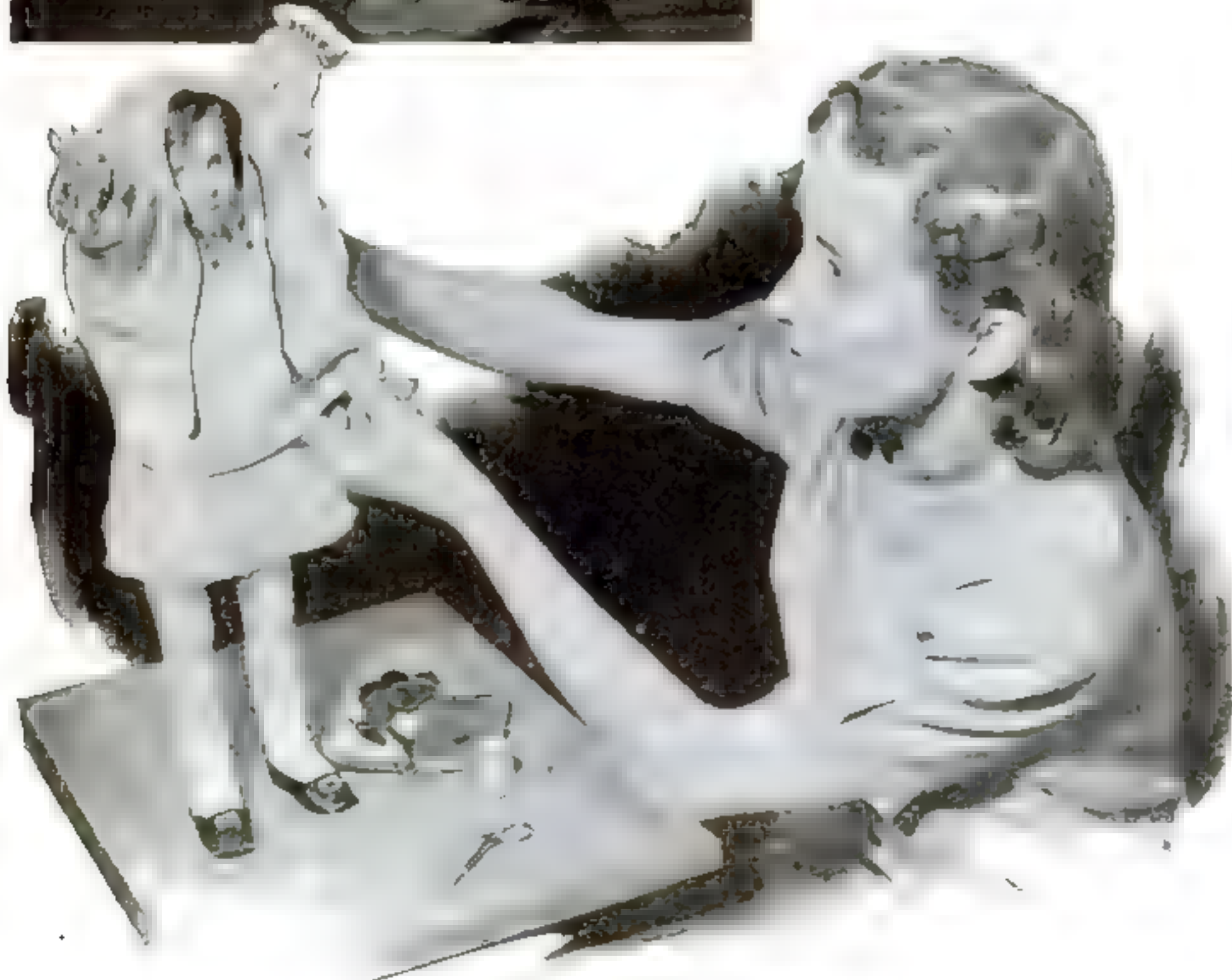
Anti-aircraft defense has proved surprisingly effective. These Chinese gunners are watching for Japanese planes

Dewees Cochran painting eyebrows on a doll head modeled from a real child. Reproducing features, expression, complexion, and even freckles, the doll's face presents a remarkable likeness

The young subject and her finished doll are seen below. Note how the artist has captured the personality of the child in a tiny figure less than two feet tall



Your Child's Portrait in a DOLL



PORTRAIT DOLLS, modeled after children or adults by Dewees Cochran, New York painter and sculptress, reproduce all the details of features, hair, and complexion found in the original. Supplementing conventional sculptor's tools with dental instruments for fine work, Miss Cochran models the amazingly lifelike figures from real life, or from written descriptions and photographs, one full face and one profile. The doll head is first shaped in a claylike material. From this a plaster mold is made in which the head is cast in a virtually unbreakable substance that simulates actual skin texture.

Hair closely matching the original is used to fashion a realistic wig, and the face is tinted to the correct flesh tones. Bodies are fashioned from another unbreakable composition material, while the hands are made of hard rubber. A skilled seamstress turns out diminutive clothes that are perfect miniature reproductions of the costumes worn by the actual model. The portrait dolls, which require about five weeks to complete, are made in proportion to the size of the child or adult, running from fourteen to twenty-four inches in height. When a photograph of the child is compared with a similarly lighted photograph of the portrait doll, it is almost impossible to distinguish between the two.

Dressing the doll. Every detail of the sitter's costume is copied in the diminutive garments, which are specially made for Miss Cochran by a skilled seamstress



Working from photographs, the artist first models the head in clay. In this process she uses several dental tools, in addition to scalpels and regular sculptors' aids

When the clay model is completed, it is used in making a plaster-of-Paris mold as seen at the right. Below, the mold is being filled with the special composition material from which the head is to be cast. This produces a virtually unbreakable head



Fresh from the mold, the head is sandpapered to a skinlike texture and painted to match the natural complexion of the subject before hair is added



The body is formed of unbreakable composition material and the hands of hard rubber. Dolls are from fifteen to twenty-four inches high, depending on the size of the child. The finished doll is seen above

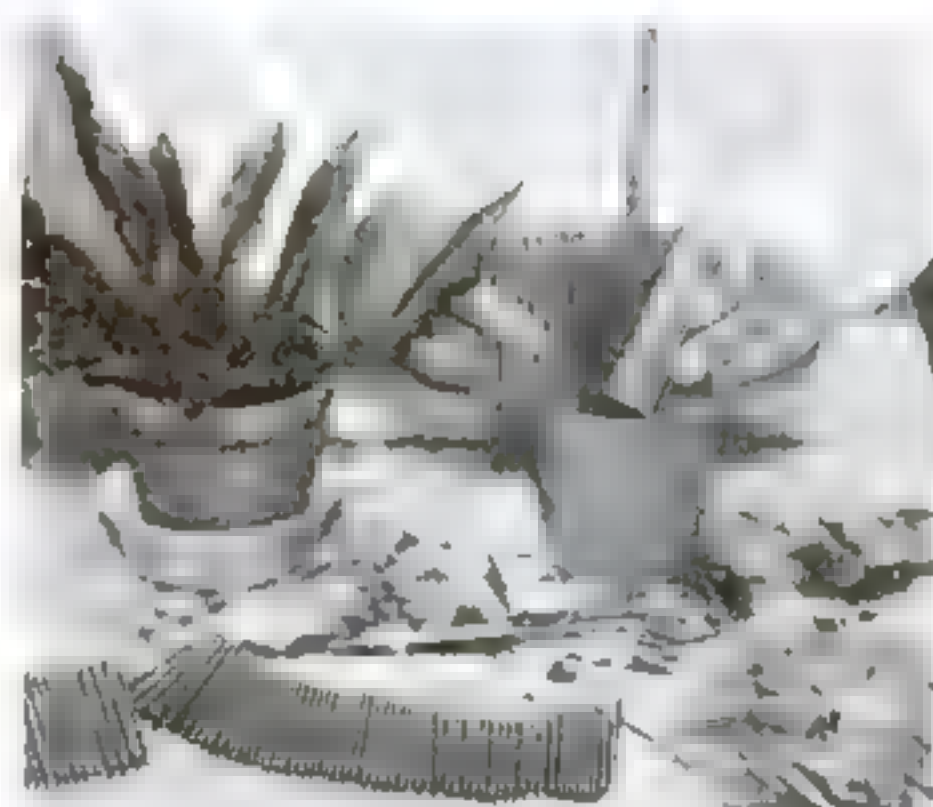
When the proper altitude is reached, the transport is released from the carrier plane



Giant Plane Boosts Transport Aloft

DESIGNED to enable a heavily loaded transatlantic plane to take off, the giant composite aircraft shown in the photograph above is now being tested in England. Carrying no pay load and a minimum of fuel, a huge flying boat

supports the smaller seaplane in a special cradle. When sufficient altitude and flying speed have been reached, the planes separate, and the large lifting plane returns to its base while the smaller craft speeds on.



Cream Replaces Silk Stockings

LIQUID cream that dries to resemble silk stockings is a new cosmetic said to be a boon to the outdoor girl. When applied to the legs, as shown below, the inventors claim that it is practically impossible to distinguish it from real silk hose.



Liquid cream applied to the skin looks like silk stockings



Tool Removes Lamp Globes

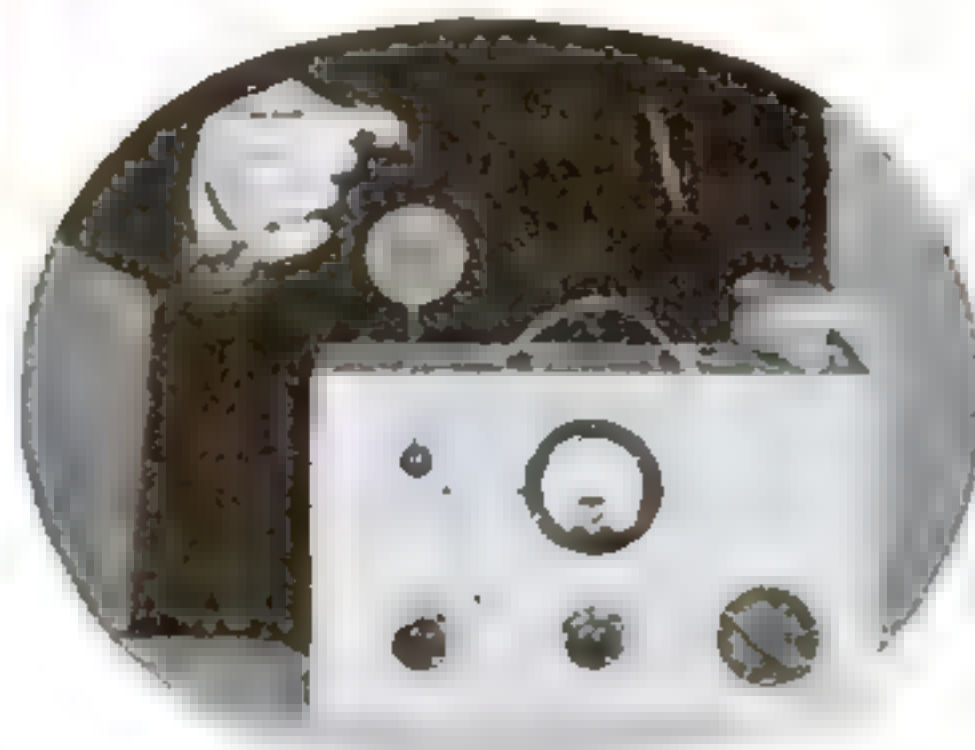
JAWS of a new adjustable tool grip ceiling light globes and reflectors for easy removal for cleaning or replacement purposes. Turning a crank operates the jaws.

Handy Paper Strips Contain Plant Food

IMPREGNATED with chemical fertilizing materials, a new type of plant food is made in the form of corrugated strips of paper. Cut to fit, the paper is wrapped around the earth of a flower pot. It is said to be odorless and to retain its effectiveness for a period of at least a year.

New Device Measures Static Electricity

STATIC electricity, present in minute quantities in various materials, is accurately measured by a highly sensitive meter devised by Charles Alextuinas, of Staten Island, N. Y. In the photograph below, the instrument is registering the electrical charge on a feather.



How the charge on a small feather is measured

Magic Paint Turns Glass into Polarizing Screen

Polarizing fluid being applied to window glass. Below, pieces of glass held so that the brush strokes are at right angles exclude all light. Lower right, coating goggles to prevent glare



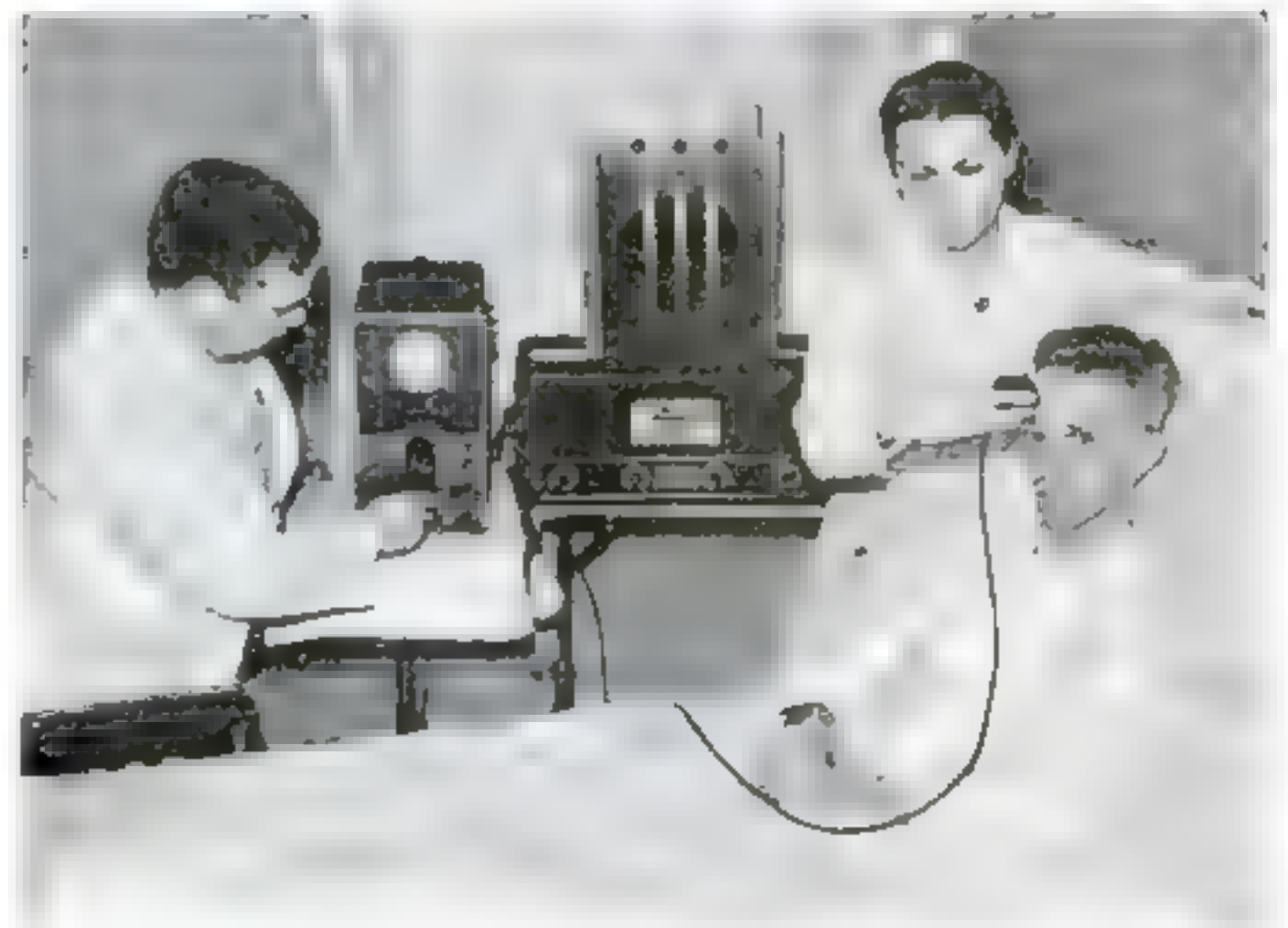
MAGIC PAINT which turns ordinary glass into polarizing glass has been announced by two New York scientists. The fluid, which can be applied with a brush and which dries in a few seconds, is the result of years of research by Maurice Zalma and Harry A. Silverman.

When this fluid, which contains more than twenty chemicals, dries in a layer upon glass or other transparent material, its molecular structure is reported to act in the manner of crystals, permitting only light rays vibrating in one plane to pass through. When two pieces of glass have been coated with brush strokes at right angles to each other, virtually all light is said to be cut off.

The new paint can be applied to window panes, windshields, goggles, binoculars, and camera filters. As it can be given any desired tint, it can be utilized to provide a combination polarizing screen and filter to eliminate glare, and give color correction, for photographic work. Eventually, it may be sold in cans like paint.

Doctors Listen to Noises in Patient's Head

WITH his head "wired for sound," George Yocum, Pennsylvania miner, faced a group of doctors and medical students at Temple University recently as amplifiers reproduced the roaring and whistling sounds that have bothered him since he suffered a skull fracture two years ago. A microphone placed against his forehead allowed doctors to diagnose his ailment as a cranial aneurysm, or swelling of a brain blood vessel.



Sounds caught by a microphone against the forehead are amplified

Baton Has Faint Glow

MADE of a clear plastic material, a new orchestra baton has a glowing red tip illuminated by a flash-light battery in the handle. Only dim light is reflected from the length of the wand. Although easy for near-by musicians to follow, it is almost invisible to the audience.

Fireflies Fight Snails

EUROPEAN fireflies are being shipped to Australia to check a plague of snails that threatens crop fields. The insects will be released to devour young snails as they hatch.



The snowplow in action and, at right, how it is attached to the bumper of a car



Snowplow Fastens to Car Bumper.

ATTACHED to a car bumper in about three minutes, a handy snowplow just introduced is designed for clearing driveways, parking lots, airports, and concrete areas around garages and filling stations. The sixty-two-pound scraping blade is adjustable and will fit any make of car. The blade automatically trips to prevent damage if a stone or other obstruction of solid nature than snow is met.

Power-Boat Fleet Polices Seadromes

FITTED with marine engines developing 100 horsepower, speedy patrol boats now being constructed in Great Britain will police the landing areas at seadromes used by commercial airlines to keep them free from obstructions when flying boats are landing or taking off. Powerful enough to tow the giant seaplanes to landing docks or moorings, the twenty-three foot boats are capable of speeds up to thirty-two miles an hour. Four of the total number of thirty service power boats ordered are shown in the photograph at the right in recent performance tests off the port of Southampton.



Christened "doodle boats," the runabouts have ample power to tow big seaplanes to moorings



This four-in-one beauty aid is little larger than milady's usual lipstick

Compact Make-Up Kit

SHAPED like a lipstick and not much larger, a handy make-up kit now available holds four different beauty aids in separate compartments. The sections, which screw together into one unit, contain lip rouge, cleansing cream, powder base, and eye shadow. The various parts of the compact accessory are pictured at the left.



Huge Roller Chain Has 350-Pound Links

LINKS like those used on a bicycle chain make up the giant chain constructed to lift the mammoth gates on Bartlett Dam in Arizona. Made of a steel and nickel alloy, the pins holding the links together are eighteen inches long and five and a half inches in diameter. Each unit of the chain, consisting of two pins and ten links, weighs about 350 pounds. The man and woman of usual stature standing beside the powerful chain indicate its mammoth size.

Ice Causes Lights on Mars

VAST ice-coated cliffs on Mars, which catch and reflect the sun's rays, have been advanced as a possible explanation of the occasional flashes of light observed on the planet through high-power telescopes. Astronomers report that the lights appear like giant explosions produced by flash-light powder.

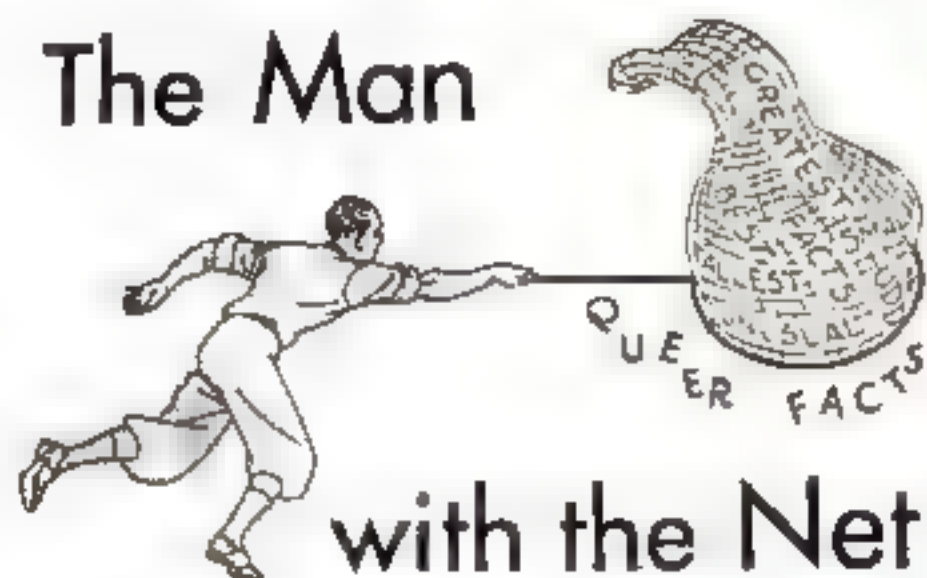
Skis Form Toboggan for Emergency Use

DESIGNED for rescue work and similar uses, four skis, bolted together into one pair, can be rearranged to form a toboggan. Metal bars across the top hold the skis parallel, while a broad canvas strip covers them, as shown at the right. Extra parts fit in a shoulder knapsack.

Each of the skis the sportsman is using actually is two skis clamped together. Right, they are arranged as a toboggan



The Man



with the Net

RAINBOWS AT NIGHT are sometimes produced when the moon continues to shine during a shower.

PENGUINS, which build no nests, incubate their eggs by placing them on top of their feet and warming them against their bodies.



DRAGONFLIES sometimes consume parts of their own bodies when hungry.

LONG-TONGUED BATS fertilize banana trees in Java.

AUTOMATIC machines, used in intelligence tests, now give pupils candy for correct answers.



PERFUME is being added to household sprays for killing insects.

DRINKING WATER usually contains more oxygen in winter than in summer.

FALSE TEETH are used by 10,000,000 Americans.

TWINS are born most frequently during the first three months of the year.



NEARLY HALF the food eaten in the United States comes out of cans or jars.

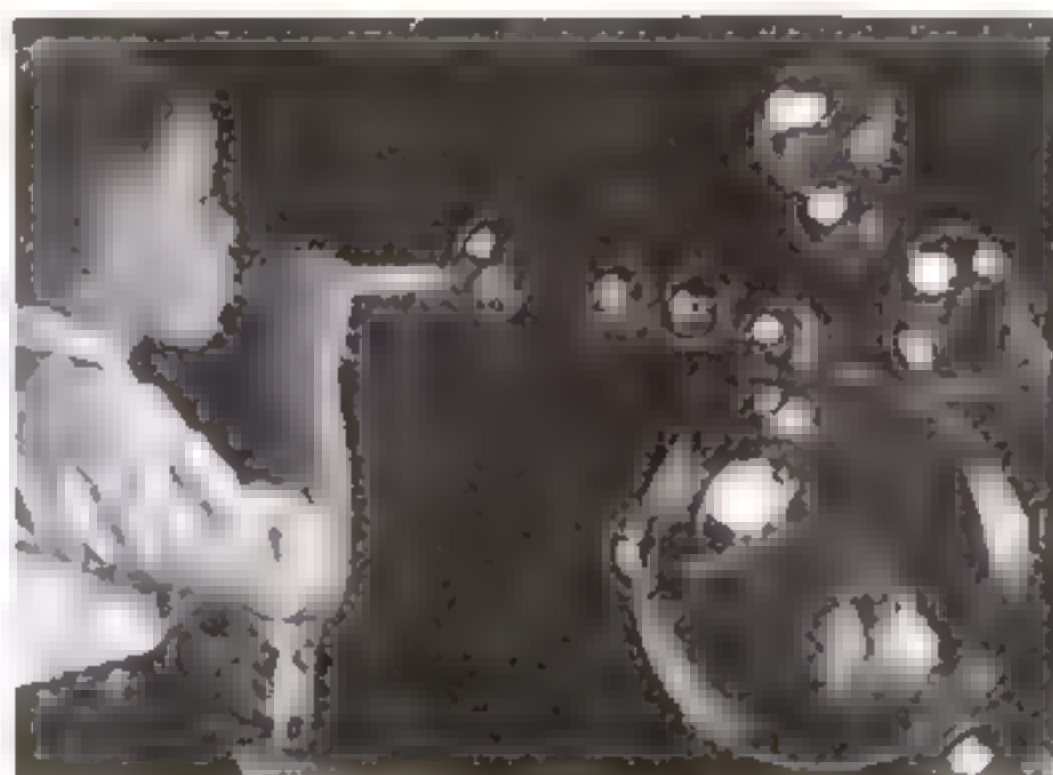
SILK DYERS become so expert at telling colors apart that they sometimes can recognize sixty shades of gray.

PREHISTORIC elephants had tusks fourteen feet long with a spread at the tips of as much as six feet.



Orchestra Climbs Mountain for Odd Concert

CARRYING their instruments on their backs, fifteen musicians recently clambered over snow fields and glaciers to a hut perched 10,000 feet up on the side of a mountain in the Swiss Alps. Arrived at their destination, they played a concert that could be heard six miles away through the thin air.



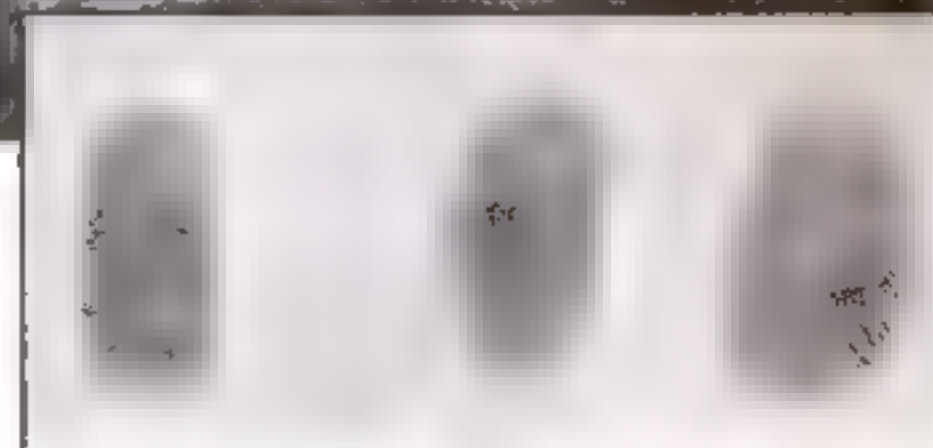
A child using the sanitary bubble blower

Sanitary Bubble Gun Blows Great, Big Ones

BUBBLES as large as sixteen inches in diameter can be blown with the sanitary fiber "cannon" illustrated at the left. In use, it is held about an inch from the lips, so that it can be used safely by several children at a party or other gathering. Metal feeder tubes and a special soap solution are responsible for the unusual efficiency of the toy, with which a skillful user can blow several bubbles at once.

Fingerprints of Twins Differ

CAN identical twins have fingerprints exactly alike? Elfriede and Auguste Sejvel, sisters who resemble each other closely in appearance, voice, tastes, and disposition, claimed that even the whorls on their finger tips were the same. Fingerprint experts were incredulous, and a test by a criminologist in Vienna, Austria, showed that their prints differed slightly.



Elfriede and Auguste Sejvel having their fingerprints taken to test their claim that even the whorls on their finger tips were alike. The prints, reproduced above, show slight differences

What Are Your

By

E. W. MURTFELDT



CRAPS. Mathematicians estimate that the odds are 251 to 244 against you when you toss the galloping dominoes in a game of craps. But don't gamble on it. Science says all dice are loaded, since it is impossible to make a perfect cube of any material with the same density throughout. British experiments indicate that a six is more likely to come up than a one, because scooping out spots makes one side lighter than another

LOTTERIES. A \$2.50 ticket in the sweepstakes may win you a fortune. But, when the officials draw the lucky numbers from among the millions of entries, what are the chances that one will be yours? Dr. Aaron Bakst, of Columbia University, says that in the Irish Sweepstakes the chance of winning a big prize is 1 in 390,000. The odds against winning even a small prize he calls over 2,000 to 1



HORSE RACING. No matter how well you know horseflesh, the odds are against you when you play the ponies. When you place your bet, the totalisator or pari-mutuel machine lops off ten percent for taxes and the track operators' cut. So, even if you won ten dollars against the real mathematical odds, you'd get only nine. You could lose money, in the long run, even if your horse won in every race

COIN FLIPPING. You would think the chances were exactly fifty-fifty that a flipped coin would land either heads or tails. Yet an English scientist tried it 25,000 times, and the result showed a definite variation from that expected under the laws of chance. It was found that the coin was not evenly balanced

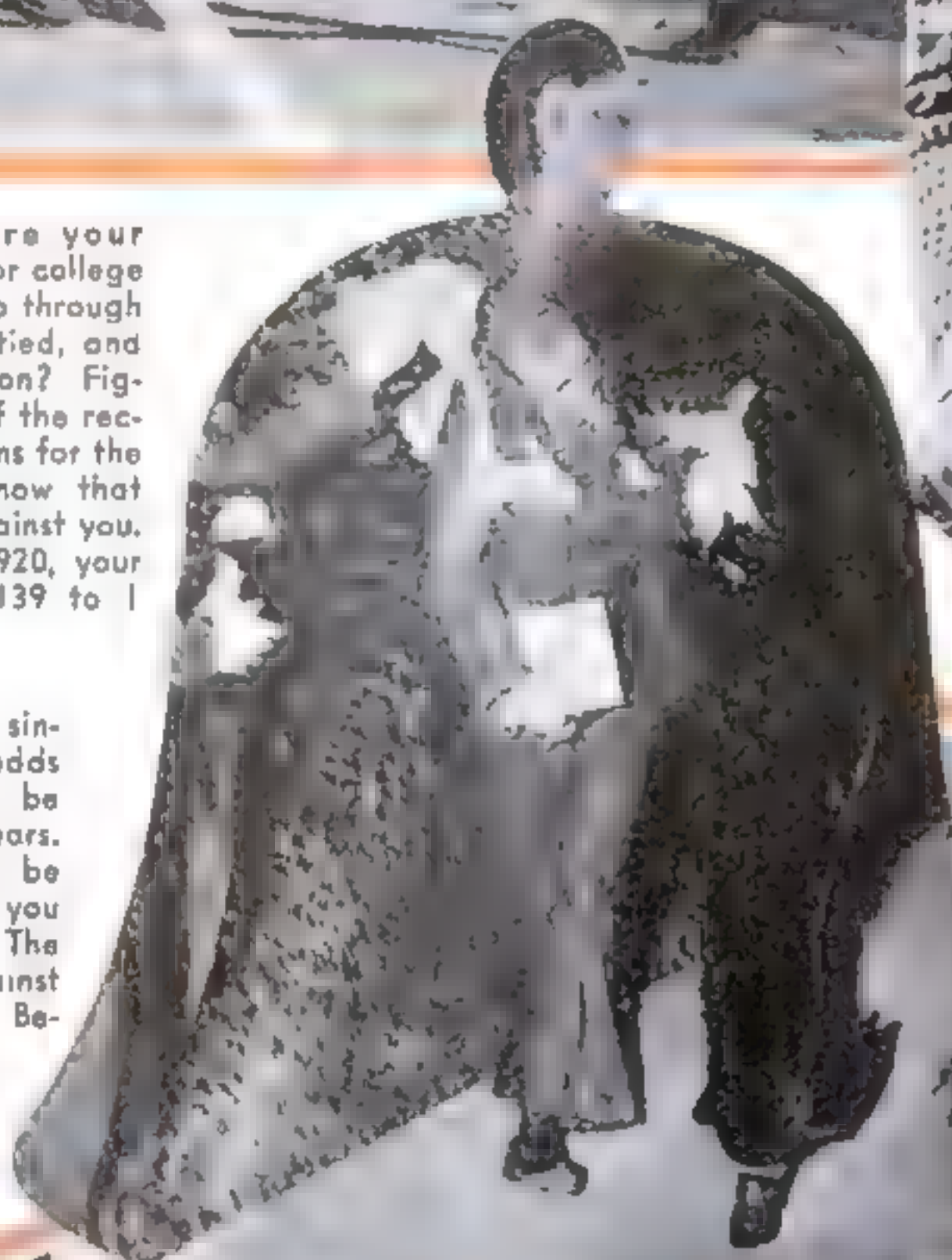
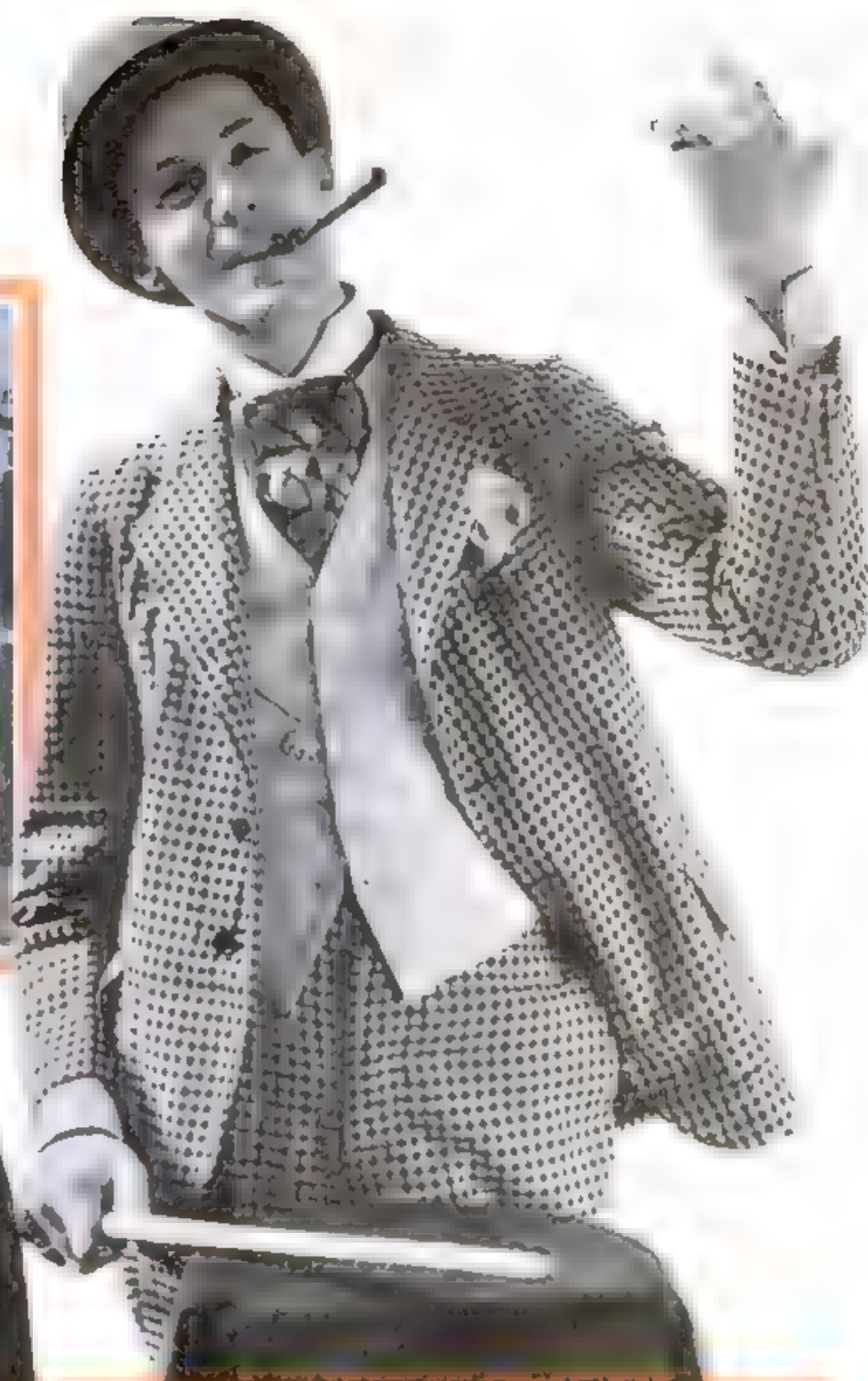


Chances?



FOOTBALL. What are your chances of picking a major college football team that will go through a season undefeated, untied, and without being scored upon? Figures based on a survey of the records of 134 leading elevens for the last twenty-five years show that the odds are 838 to 1 against you. Based on games since 1920, your chances will slide to 1,139 to 1

MARRIAGE. If you're a single man of twenty, the odds are 10 to 9 that you'll be married within five years. Your wife probably will be younger than you, and you will have three children. The odds are 4 to 1 against your getting a divorce. Before any child is born, the chances are 1.06 to 1 that it will be a boy



ROULETTE. A research worker watched nearly 10,000 spins of a roulette wheel and found that if he had bet a dollar on the black each time, he would have lost \$262; if he had bet on the red, he would have lost \$280. The bank can't lose!

BRIDGE. Calculators report that there are 635,013,559,600 possible combinations of cards that can be held in a hand at bridge. Therefore, it's exactly 635,013,559,599 to 1 that you won't have a fainting spell as a result of picking up thirteen spades in any hand. It's about 153,000,000,000 to 1 that you won't draw thirteen cards of any one suit, and about 300,000,000 to 1 that you won't draw twelve of the same suit



Warships Tested in

TO DESIGN better men-of-war and merchantmen, the U. S. Navy Department is building one of the world's biggest and finest model-testing basins at Carderock, Md. When it is completed, scale models of projected vessels will be towed along tanks resembling huge indoor swimming pools, while delicate recording instruments indicate their drag or resistance to passage through the water. Cameras mounted overhead will record the behavior of self-illuminated models during turning trials conducted with all other lights extinguished. A 1,600-foot tank for high-speed trials, and a low-speed tank that can be divided into two separate sections by a water-tight gate, will enable as many as three different models to be tried out simultaneously. From the tests, naval architects will be able to predict the speed, required horsepower, maneuverability, and riding qualities of any design proposed for new vessels to be constructed.

Carriages that tow the models at speeds of from ten to thirty knots will

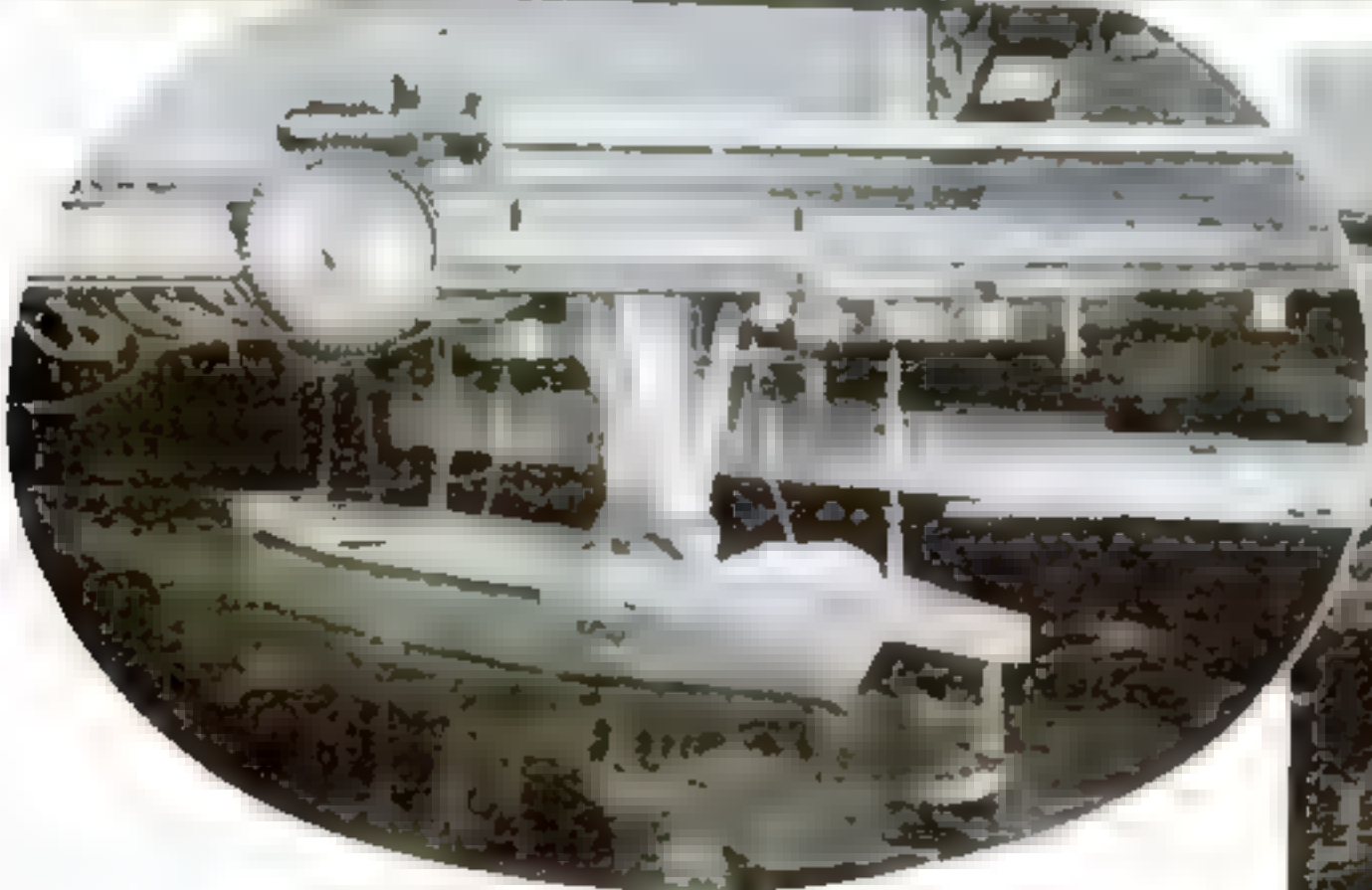
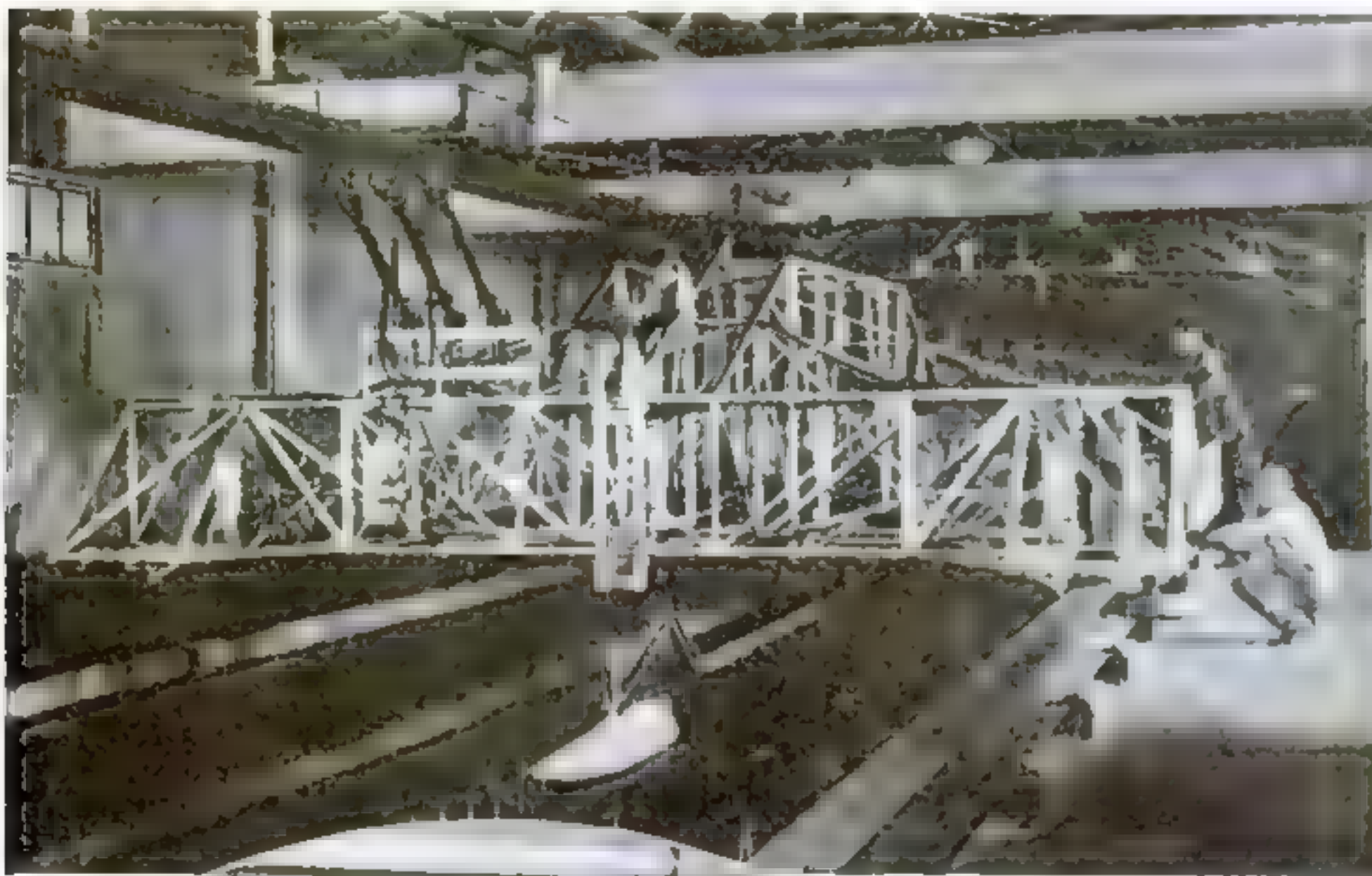
have a novel form of propulsion. Electric motors of synchronous or self-regulating type, turning in step with the power impulses of their alternating-current supply, will drive oil pumps on the towing carriages. From the pumps, a constant stream of oil under pressure will flow to hydraulic motors, which will propel the towing carriages along their rails. Thus the speed of the model can be regulated with the precision of an electric clock, guaranteeing the accuracy that is essential in this very exacting work.

Even the curvature of the earth has been taken into account. For extreme accuracy, the track for a towing carriage must be absolutely parallel with the level of water in the tank. Since the surface of the water follows the earth's curve, the rails of the track will be especially shaped to do likewise—a refinement of design that means the bowed ends of a quarter-mile-long track will depart from the level of a surveyed straight line by scarcely more than the thickness of a couple of worn dimes!

Such extraordinary precautions will offset the possibility of minute errors that might be magnified to sizable proportions in multiplying test findings to the scale of full-size vessels.

Today, models and testing tanks are used by experts the world over to design ocean greyhounds, racing yachts, and warships, as well as hulls for flying boats and pontoons for seaplanes. Older test basins are becoming outmoded by the need of precision trials for high-speed vessels, and ultra-modern tanks have recently been constructed in England, Germany, France, and Italy. The new installation at Carderock, Md., will place this country in the forefront of naval research at a time when our program of warship construction includes the first battleships we have built in fourteen years, and our merchant marine is soon to be augmented by ninety-five new vessels including twenty-five high-speed passenger and cargo ships.

Commander H. E. Saunders, U.S.N., who is in charge of the construction of the mammoth test basin



The upper view shows a traveling carriage of the type that will tow models through the tanks. The method of attaching the model is seen in the oval

Right, an apparatus in an English laboratory for testing the seaworthiness of lifeboats



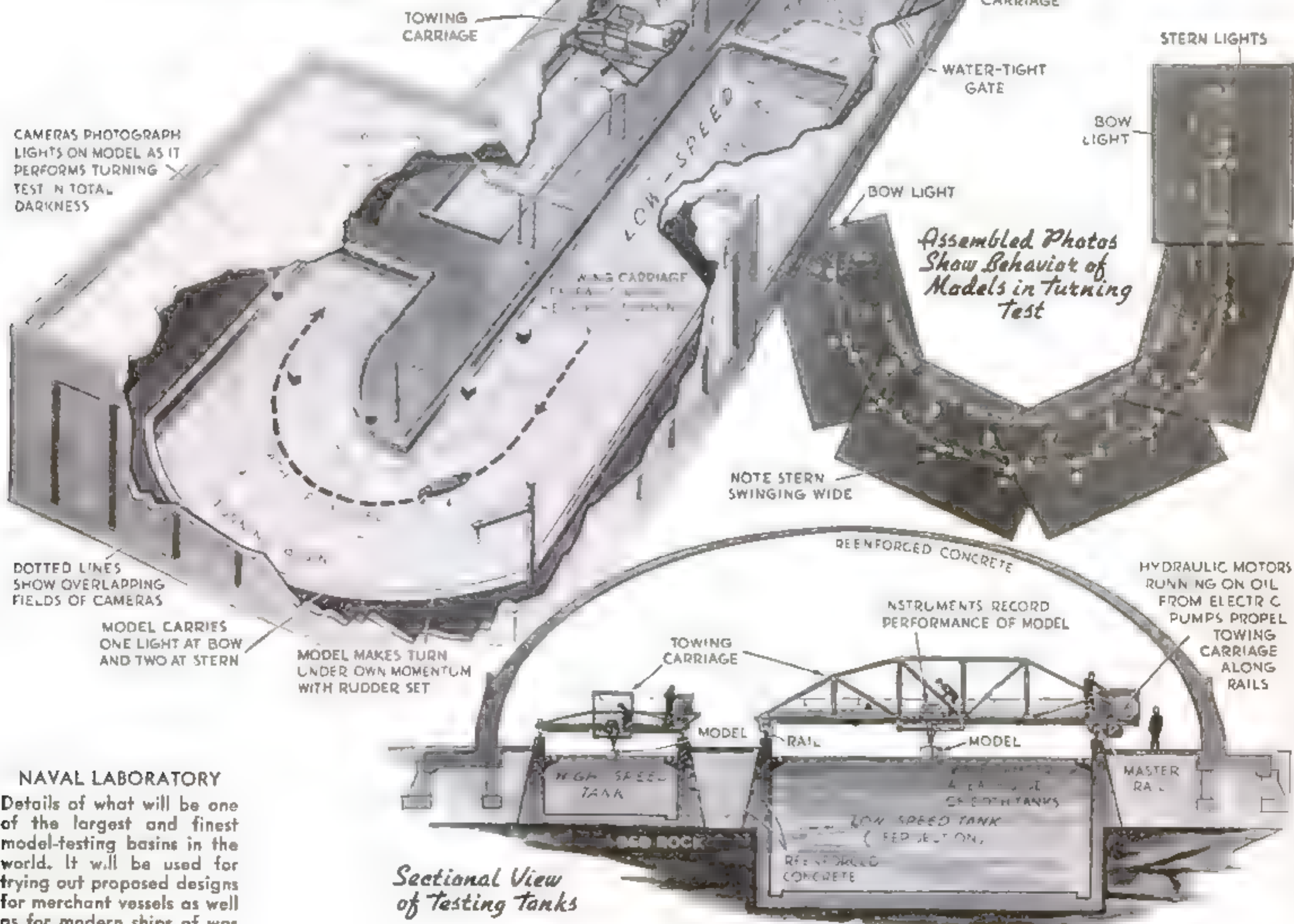
Miniature Ocean



A model showing the exterior of the projected ship basin at Carderock, Md. Left, Navy designers examining a scale reproduction of a battleship of new design

Drawing by
B. G.
SEIELSTAD

How Ship Models Will Be Tested in Navy's New Basin



NAVAL LABORATORY
Details of what will be one of the largest and finest model-testing basins in the world. It will be used for trying out proposed designs for merchant vessels as well as for modern ships of war



World's

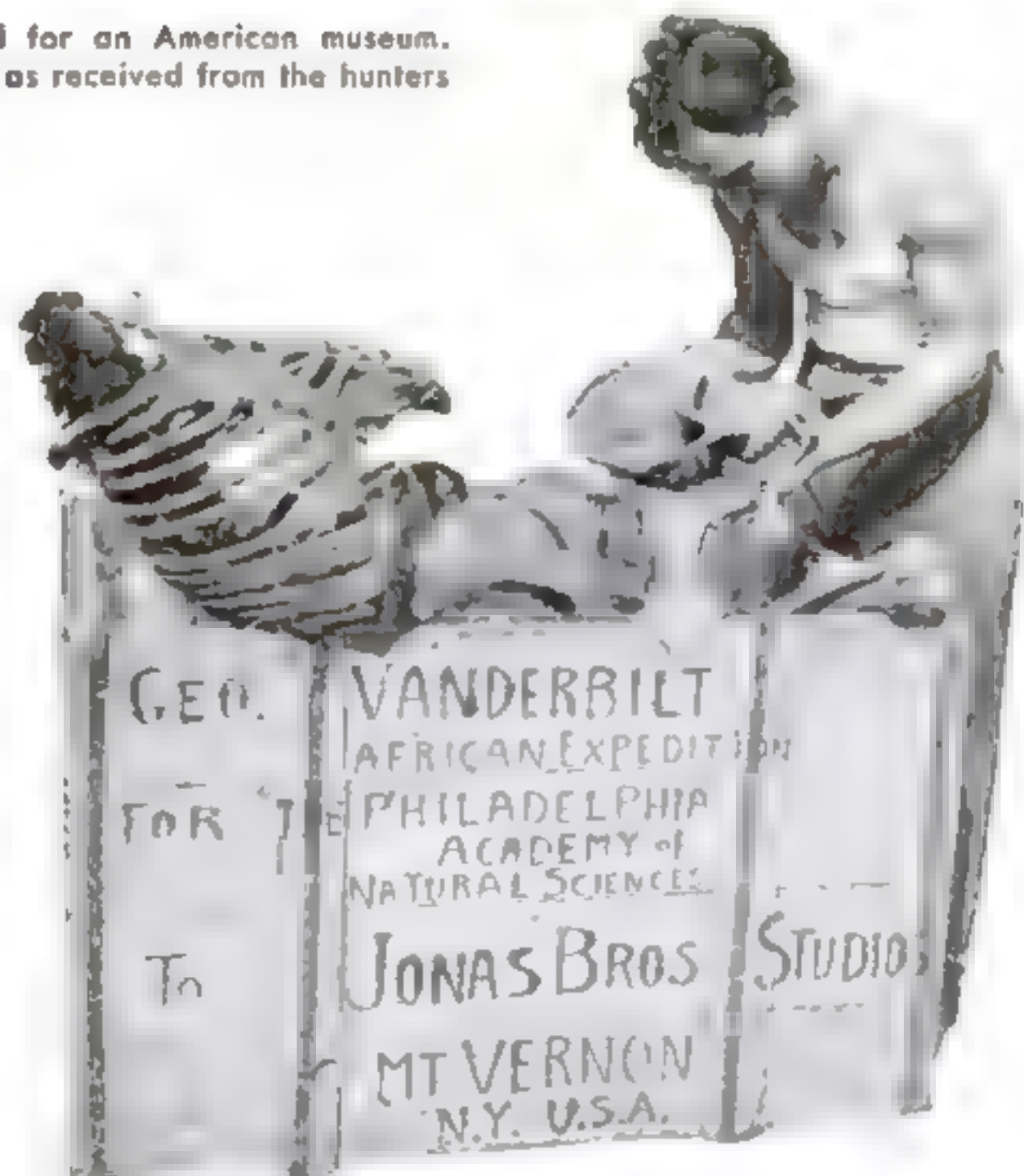
A giant of the African forest restored for an American museum. Below, the bones of the original animal as received from the hunters

AMAZINGLY lifelike, the mounted body of the world's largest gorilla, a 500-pound giant, is being put on exhibition at the Academy of Natural Sciences, in Philadelphia, Pa. The enormous brute, together with its mate and baby, were bagged by a recent West African expedition led by George Vanderbilt, New York sportsman and explorer. The delicate work of mounting the gorillas was accomplished at the Jonas Brothers Studios, in Mt. Vernon, N. Y. On these four pages, you find pictured the successive steps, combining sculpture and taxidermy, which "brought to life" the jungle family.

As an initial step, the experts assembled the bones of the skeleton by means of wires and steel rods. On this framework, Louis Jonas modeled the body of the brute in clay. Coating this with a lubricant, he applied successive layers of plaster of Paris. After this mold was dry, it was removed in sections and into each part an assistant pressed layer after layer of wet paper which dried to form a light, tough, papier-mache body, the parts of which were glued and nailed together.

Before the skin was put in place, the papier-mache was coated with a flexible plaster containing nine secret ingredients. This material remains plastic for a considerable time and enables the taxidermists to press and pinch the skin into the wrinkles and lines which give the finished work its amazing realism. The technique which has been developed at the Mt. Vernon studios is called sculpturdermy.

Scientists who have examined the Vanderbilt gorilla estimate it is thirty-five years old. It stands six feet high and, with both arms extended, has a reach of fully nine feet. Its neck is twenty-eight inches in circumference and its chest measures sixty-eight inches, contracted, and seventy-eight, expanded. Surprisingly little is known about the life of gorillas. They are shy vegetarians, dwelling in the deep forests and soon dying in captivity.



**In the Remarkable Series of Pictures
Reproduced on these Pages, You See How
Sculpture and Taxidermy Were Combined
To Re-Crete a Rare Animal Specimen**

Largest Gorilla

PRESERVED BY NEW ART OF SCULPTURDERMY



The first step is to assemble the skeleton and set it up in the pose it is to have in its final setting, as seen at the left. The bones are held together with wires. A wire screen is built up to represent the large stomach that is characteristic of gorillas in a wild state



At the right, Louis Jonas is covering the assembled skeleton with clay which he will model into an exact representation of the body of the original animal. All dimensions and proportions are calculated for scientific accuracy as well as for artistic realism



Now covering the bones completely, the clay coating replaces the flesh of the gorilla and shows all anatomical details with perfect fidelity. At this stage, the figure assumes proportions not shown by the bones alone



At the right, plaster of Paris is being applied to the finished clay figure to form a mold. Previously, the figure was greased so that the various sections of the mold will come off easily when it has hardened



Here a section of the mold, removed from the clay figure, is being lined with softened building paper coated with an adhesive paste. Built up inside the molds, this material dries to form a complete shell exactly like the clay figure. This shell serves as a lifelike mounting for the skin, as shown on the next page



Parts of the cast being assembled to form a hollow figure on which the skin will be mounted. At right, workers are smearing the figure and the skin with a special flexible plaster that remains soft while the skin is fitted around the imitation body



Here the skin is in place and ready to be joined at the back with invisible stitching. This step is a critical one, as any errors in the sculpturing would result in the skin failing to fit properly

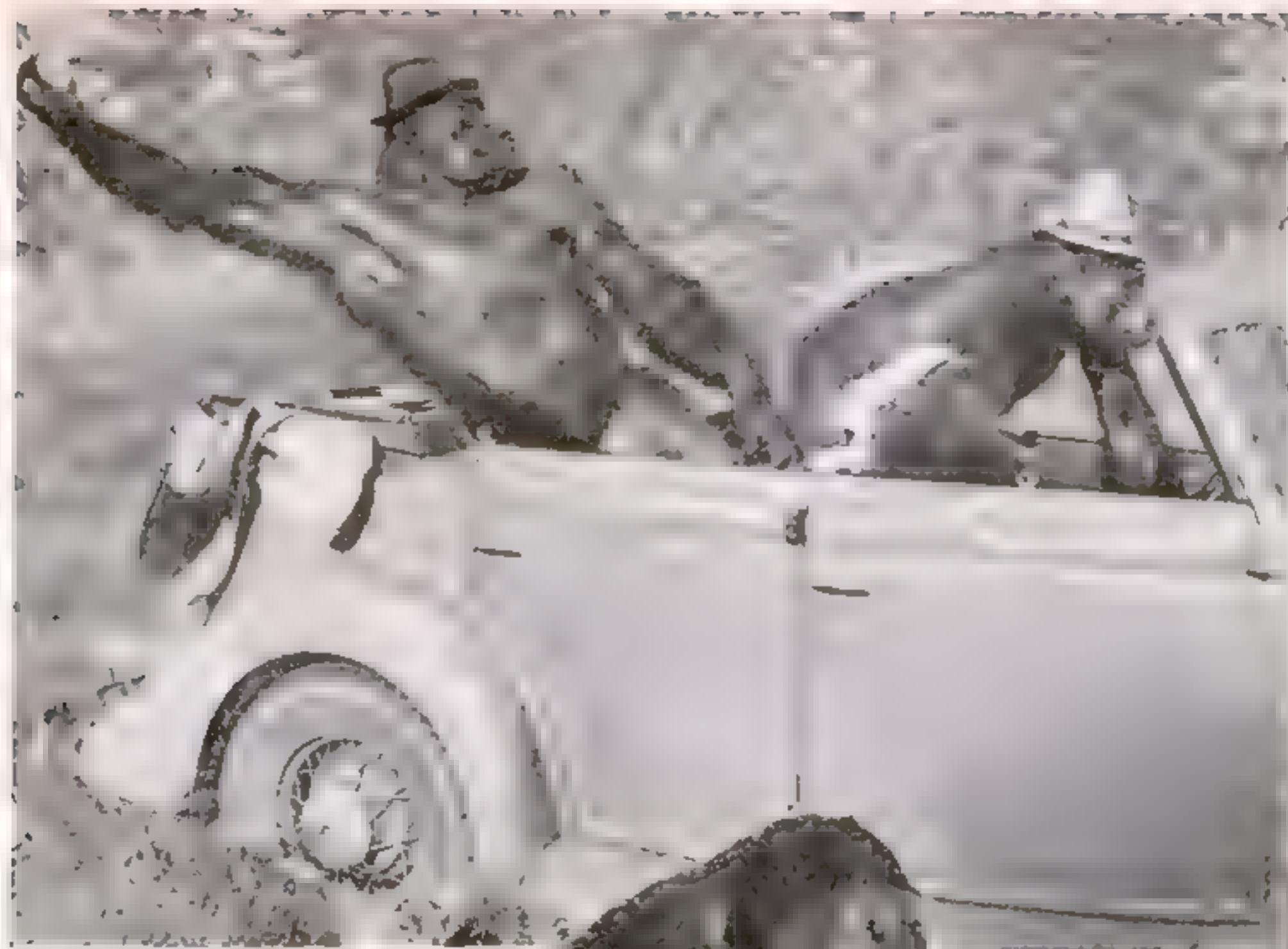


With the skin sewed on, the sculptor proceeds to the important job of working the loosened pelt until every line and wrinkle is just as it was in life. The delicate task must be finished before the cement dries and hardens

A BIG THRILL FOR MUSEUM VISITORS

At the right are the giant gorilla with his mate and a young one, as they will be preserved at the Academy of Natural Sciences in Philadelphia, Pa. All three of the animals were mounted in the manner described here





Not a party of Sunday drivers, but the gorilla group posed in the automobile in which they were transported to an outdoor setting to be photographed. A few "props" made the picture complete



A young woman attempts to duplicate the pose of the female gorilla—without success, because she has to kneel in order to make her back parallel to the gorilla's, while the gorilla's legs remain extended



The skeleton of an adult human compared with that of the male gorilla. Striking differences can be observed in the size of the skulls and shoulder blades. The gorilla had a chest measurement of seventy-eight inches when expanded



It is impossible for a human to assume the same position as a gorilla, as shown by this photograph of a child beside the skeleton of the young animal. There are great differences in bone proportions and joint structure



An athlete trying to stand like the figure of the male gorilla. The pose is so unnatural for a man that it is a terrific strain to maintain it for even the instant required to snap the picture

By
**EDWIN
TEALE**

Since the discovery of amazing mineral-water wells, a small New Jersey town has become a flourishing community. Banners and signs along the roadside guide visitors to the wells



Mineral-Water Gushers Bring Sudden Wealth In Strange Boom



The happy Munkacsys who first discovered the valuable mineral water when they sank a well in their back yard. The shed that houses the well shows in the background

On Sundays, entire families visit the wells to carry home a week's supply of the water. Over one week-end, one well owner sold 9,200 gallons to visitors at ten cents a gallon



SUDDEN wealth and all the excitement of a western boom town have descended on a quiet farming community in northern New Jersey. Twenty miles from New York City, drilling rigs are puffing and clanking from morning until night. Steel pipes are probing the earth for a liquid bonanza. Photographers, promoters, reporters, and newsreel cameramen are swarming over the area. On a Sunday afternoon, as many as 100 cars an hour inch their way down narrow Lane Road, in Caldwell Township, carrying people to buy thousands of gallons of a magic fluid which was tapped by accident. The community is in the grip of a unique mineral-water boom.

It all began, some months ago, when John Munkacsy ordered a new well drilled on the picnic ground which he operates on the south bank of the Passaic River as a sideline to his work as an expert model maker for inventors. On New Year's Day, 1937, the drillers struck water which poured out in an artesian well, flowing at the rate of 3,000 gallons an hour.

The owner of the new well took a drink of the water and was disappointed at its hard, flat taste. The next day, his wife boiled some potatoes in the water. At the end of an hour, they were still hard, and at the end of ten hours they were like rocks. Munkacsy complained bitterly to the drillers. They suggested that he send samples to the state Department of Health, in Trenton. The analysis came back and the excitement began. The report of the chemists showed that Munkacsy, instead of having an ordinary well, had something like a gold mine.

His water contained calcium, magnesium sulphate, and a wide variety of minerals essential to health. Its alkaline rating was

more than twice that of the average New York City water. Neighbors who began drinking the alkaline fluid reported the alleviation of various ailments, ranging all the way from high blood pressure to rheumatism. The fame of the artesian well spread. By mid-summer, people were driving from twenty miles away to buy the water from Munkacsy's well.

At first, Munkacsy sold it for two cents a glass or ten cents a gallon. His well has a steady flow of 3,000 gallons an hour, or 72,000 gallons a day. During a single week-end, he sold 9,200 gallons at ten cents a gallon, a total of \$920. Even after he raised the price to fifteen cents a gallon, he was swamped with orders.

Customers arrived with vinegar jugs, wine bottles, milk cans. One man unloaded fifteen one-gallon jugs from the back of an expensive limousine; another drove up with a 600-gallon tank truck, such as is used for transporting milk, and wanted it filled with water from the spring. Users told of being helped by the water in many ways.

Traffic congestion on the narrow dead-end road that leads to the Munkacsy picnic ground became so bad on week-ends that the entire police force of North Caldwell, the nearest town, had to be on duty miles out in the country each Sunday to direct traffic. Because many customers came without containers, Munkacsy started doing a rushing business in glass jugs. He has sold as many as 1,000 gallon containers, at a quarter apiece, in one day.

Munkacsy's neighbors were far from idle during this flood of prosperity. When they saw him giving away twenty-five-cent cigars to reporters and showing other signs of sudden opulence, a frenzy of drilling began. The Parkhurst Well and Pump Company, of Verona, which had brought in the Munkacsy well, was kept working at top speed. Austin Voorhes, the veteran driller who had been in charge of the



A visitor on crutches, above, makes a purchase. Right, Mrs. Munkacsy learned the water was really "different" when potatoes boiled in it became as hard as rocks

work, was especially in demand. A second drilling company pulled its rigs into the neighborhood to take advantage of the boom.

One well went down within a foot of the Munkacsy property line. Another was drilled in a cow pasture directly across the Passaic River. A third went down in a chicken runway, and a fourth beside a grape arbor in a back yard. Within an area of less than a square mile, nearly a dozen wells were hurriedly drilled to tap the subterranean treasury of mineral water.

According to geologists, the depressed strata of rock under this northern New Jersey valley (Continued on page 130)



Austin Voorhes, the old-time well driller who started the strange boom by bringing in the first well. His services have since been much in demand by near-by residents. At left, a typical back-yard well being sunk

The head of an old iron bed supplied the frame for this comedian's bicycle



Odd Bicycle Made from Bed

AN ENGLISH comedian recently entertained crowds at a cycling meet by riding the odd bicycle shown above. The frame of the curious wheel was made from the head of an old iron bed, to which old bicycle parts were added.

New Globes of World Can Be Corrected

NEW globe maps of the world never go out of date. When there are revisions to be made as boundaries change or areas are annexed, globe owners are sent decalcomania transfers containing the corrected map areas, which are easily applied.



Decalcomania transfer being applied to globe

Green Replaces Red in Make-up for Television

GREEN lipstick and rouge replace the customary red in make-up designed for actresses appearing in television broadcasts. The television camera, it is explained, does not record the red coloring in the human complexion, leaving the transmitted image flat and unnatural. When green is substituted, however, the lips and cheeks of a performer appear in accurate relation of tones with other facial features as the image is projected on the screen of the receiver.



Betty Grable, film star, being made up for television



A bulb and dry cell in the handle give light

Screw Driver Has Built-in Light

DESIGNED for home owners, mechanics, and service men, a screw driver fitted with a flash light is handy for work in dark places. The octagon-shaped handle of the tool houses one standard battery cell and a flash-light bulb that illuminates the work, as shown at the left. Provided with a clip, the small device fits into the pocket.



Smoke Marks Location of Practice Torpedo

TO FACILITATE the recovery of dummy torpedoes used in target practice by the German navy, chemicals packed in the head of the shell release clouds of smoke after it is fired. In the photo-

graph above, sailors on a German ship are shown retrieving a torpedo which was located by means of its telltale stream of smoke after its compressed-air motor had come to a stop.

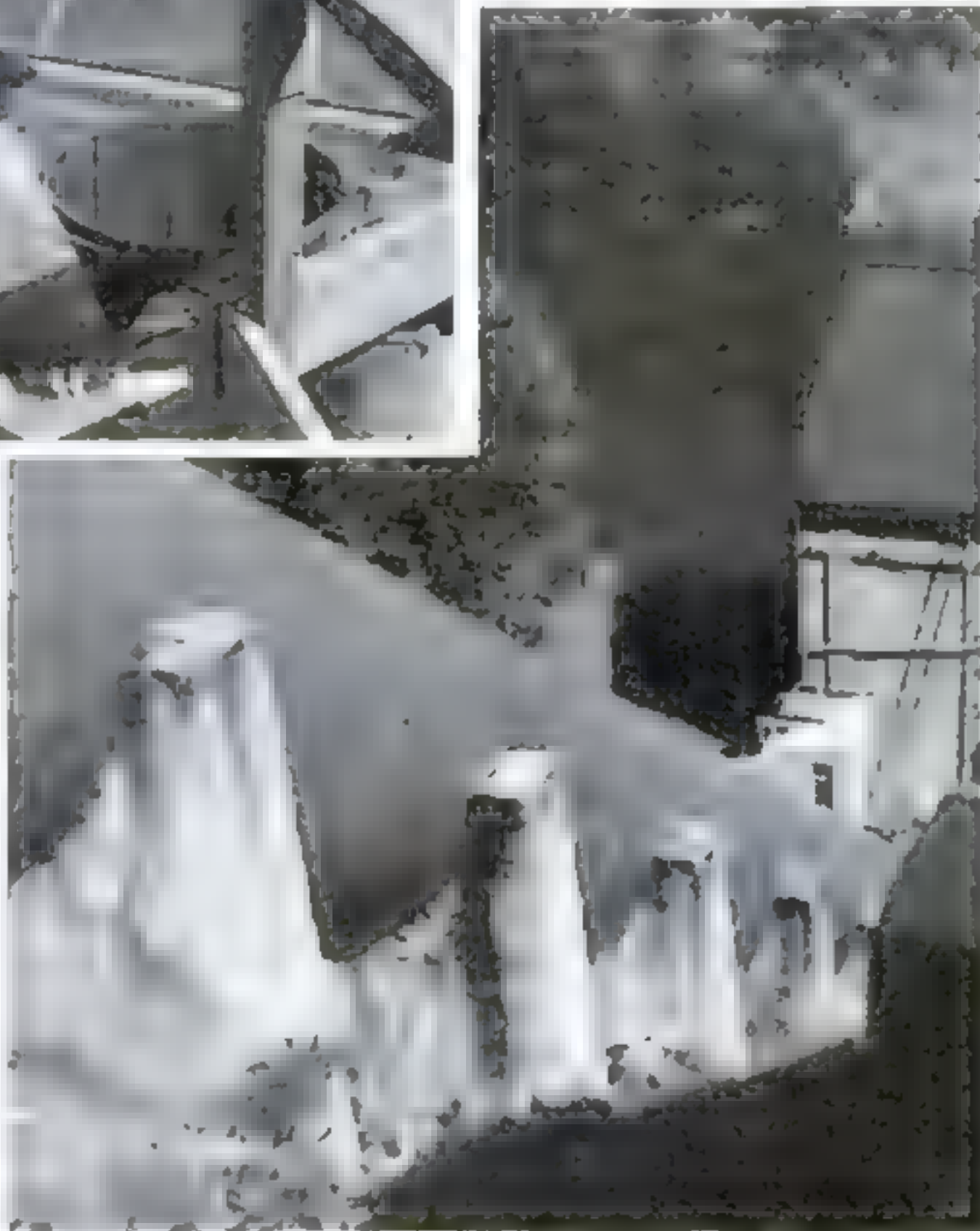
Young Fish Routed Through Turbines in Novel Test



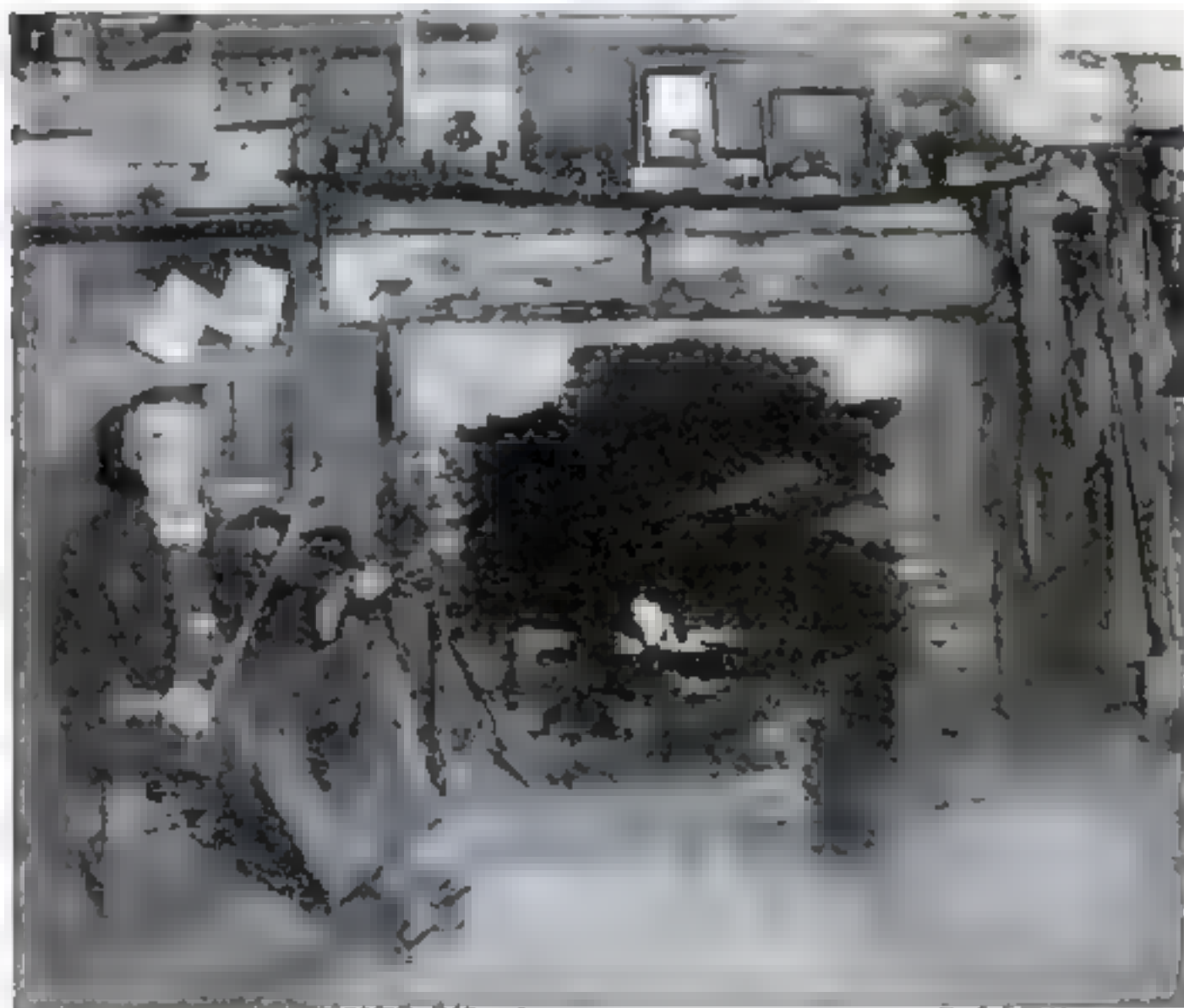
A conservation worker lowering a paper bag containing fish into the large intake end of a turbine penstock

By jerking the line, the bag was broken and the young fish were sucked down this huge draft tube

At the turbine outlet, a diver caught the fish in a net and transferred them to a waiting boat as shown at the extreme right



WILL the whirling turbines of power stations at huge dams destroy young fish as they make their trek from mountain streams down toward the sea? To answer this question, the state game commission of Oregon recently made a novel experiment at Cazadero Dam on the Clackamas River in the presence of conservation officials from various state and Federal bureaus. Fingerling salmon and trout taken from the water above the dam were placed in paper bags and lowered to the mouth of a penstock carrying water down to the turbines. By pulling on the attached cords the bags were broken, expelling the fish into the tube. Clad in a diving suit, an observer stood on the river bottom at the outlet of the turbine to net the fish as they emerged. Results showed that approximately fifty percent of the fish were killed by the long drop, sudden pressure changes, and whirling turbine blades. However, Dr. Harlan B. Holmes, aquatic biologist in charge of the experiment, pointed out that this power plant was not typical, running faster and providing smaller turbine-blade openings than in other plants. Where larger wheels and shorter drops prevail, he stated, the route through the power wheel might be the most favorable passage for the fish, providing a safer journey over the giant dams.



Fire Has Burned for 147 Years

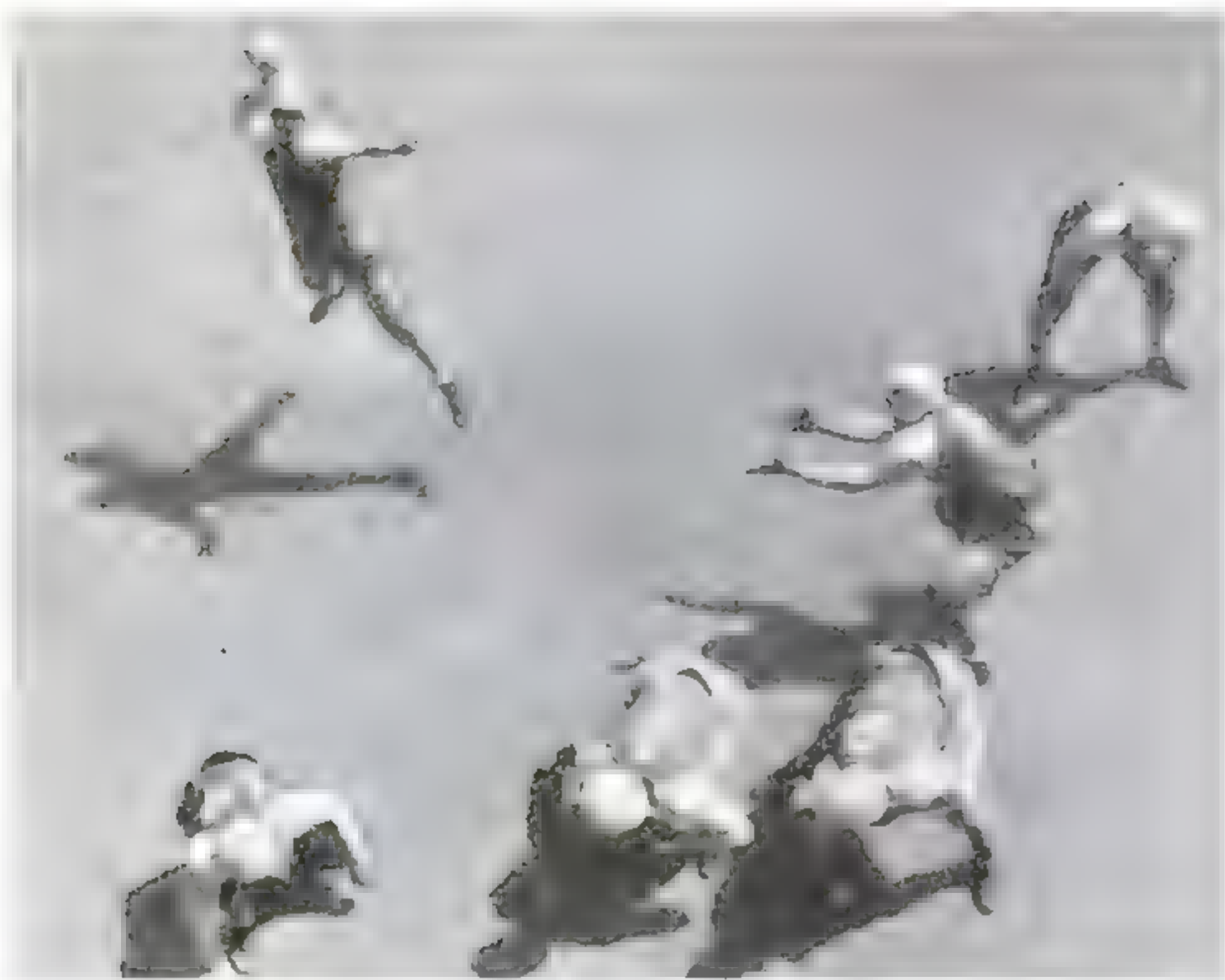
IN HIS mountain cabin near Saluda, N.C., Bill Morris patiently tends a fire kindled when George Washington was president. The fire was started 147 years ago by the great-grandfather of the seventy-seven-year-old mountaineer. It is proposed that the flame be moved to a near-by museum to be kept alive permanently.

Germans Try Out Mystery Gun

THE novel one-man antiaircraft gun seen in the photograph below is now being tested secretly by German army experts. The gunner, seated behind the barrel, controls the gun accurately and rapidly by means of foot pedals and hand levers, according to reports.



New German antiaircraft gun now undergoing extensive secret tests



A sample formation in the midget variety of football. Line and backfield have three men each

Glass Lips on Public Phones Aid Germ Census

GLASS LIPS attached to telephones were used by Dr. Florence Stone and Dr. Calvin Coulter of Columbia University to collect disease germs present in public telephone booths. After an eighteen-month survey in many parts of New York City, it was discovered that, despite the confined space and frequent use of phone booths, concentration of germs was no greater than with private phones.



Experimenters with glass phone lips they used to collect germs

Trailer Is Mobile Hospital for Forest-Fire Fighters

HOUSED in a streamline trailer, a mobile hospital just placed in service by the California Forestry Medical Corps will be used for treating injured persons near the scenes of forest fires, earthquakes, airplane crashes, and

other unpredictable disasters. The rolling hospital is equipped with an operating table, folding cots, sterilizing apparatus, and other supplies with which about 3,000 emergency cases may be handled.

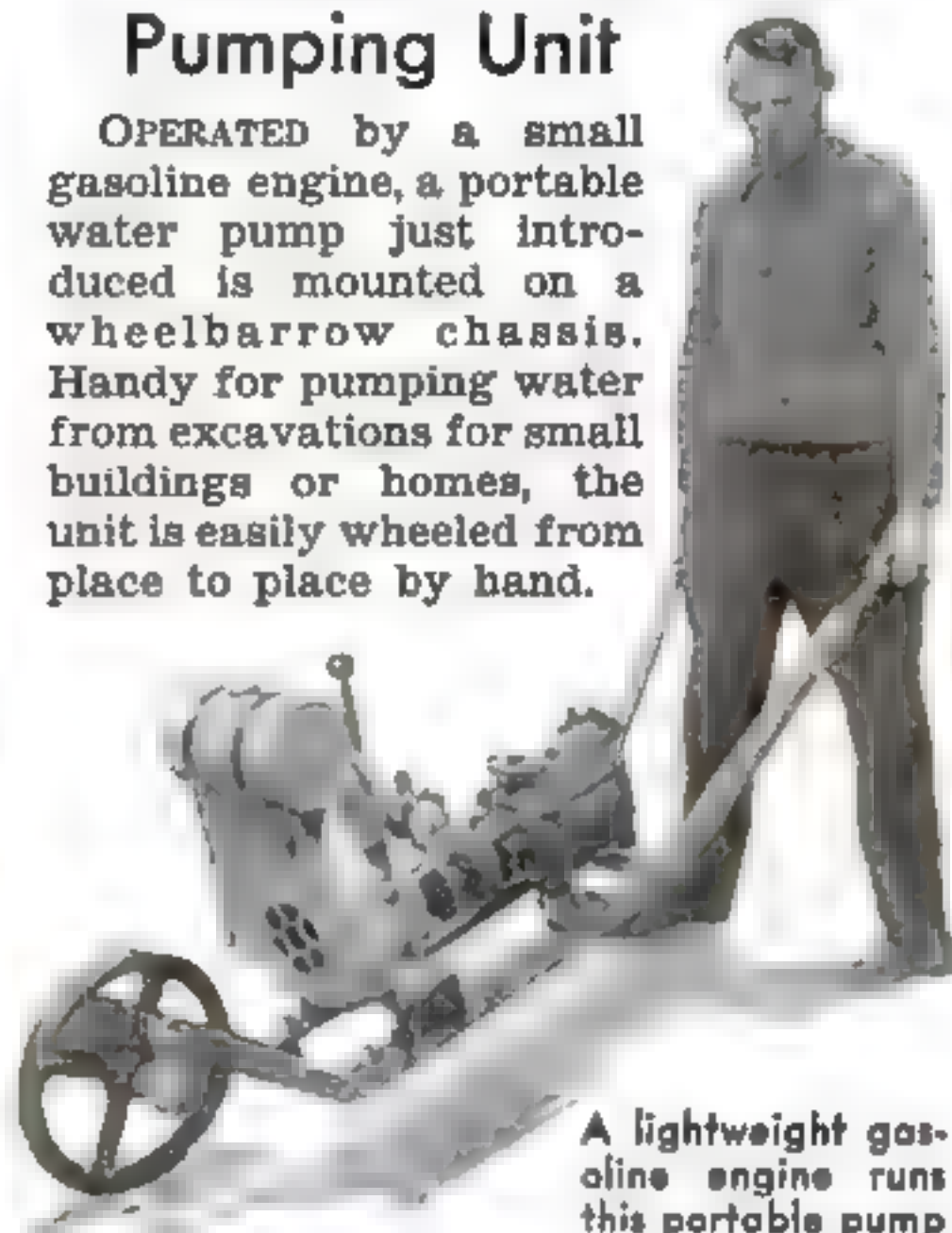


Six Men Make a Team in New Football Game

SIX instead of eleven men constitute a team in a simplified version of football recently introduced by players in Los Angeles, Calif. Three men compose the line and three the backfield in the new game, which is played on a gridiron that is much smaller than the regulation size.

Wheelbarrow Carries Pumping Unit

OPERATED by a small gasoline engine, a portable water pump just introduced is mounted on a wheelbarrow chassis. Handy for pumping water from excavations for small buildings or homes, the unit is easily wheeled from place to place by hand.



A lightweight gasoline engine runs this portable pump

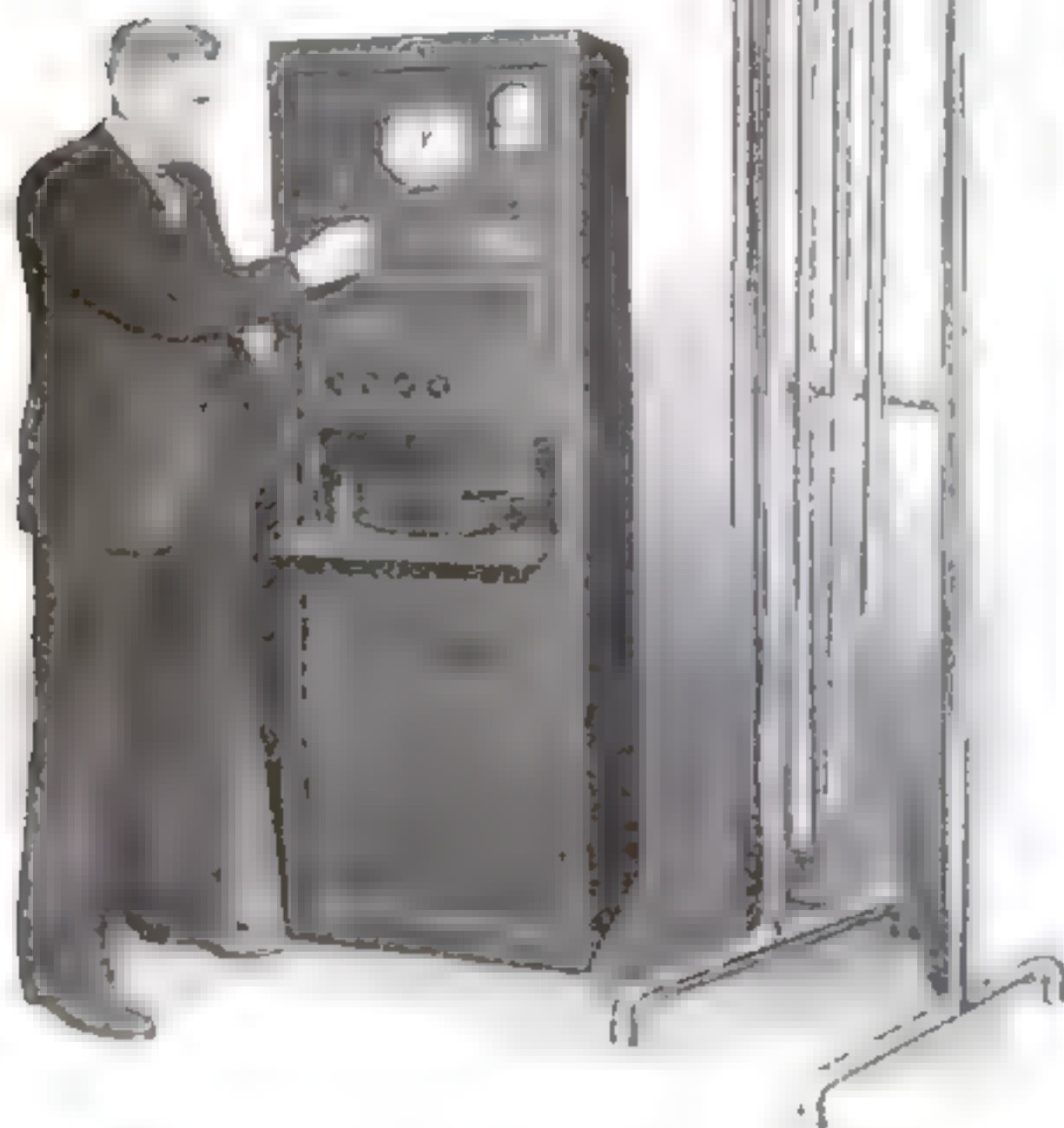
Test Masks for Babies

A GAS MASK for every British baby is the goal of tests being conducted by government officials on seventy infants at an institution in England. The experiments may show the way to economical large-scale production.



Cabinets like this, built into the walls, add to the efficiency of the rolling hospital at the left

This unit transmits the sound of recorded music or chimes to amplifiers on the cemetery grounds



Cemeteries Get Music System

WITH amplifiers placed at various locations about the grounds, a public-address system is now being used to provide appropriate music in cemeteries during burial services. The unit is equipped to transmit the sound of chimes or of recorded selections of religious music to that part of the cemetery where it is wanted.

Rubber Mallets and Balls Pep Up Croquet

BOTH the mallet heads and the balls of a croquet set just placed on the market are made of rubber. Said to be truer and more uniform than those made of wood, the rubber sets are expected to speed up the game and make skill a more decisive factor than chance in determining the outcome for the players.



Making a difficult shot with the croquet set. Mallet heads and balls are rubber

Air Stream Blows Dust from Around Drill

COMPRESSED AIR forced through the hollow drill shaft of a new rock-boring tool blows out dust and debris, thus eliminating the necessity for flushing the hole with water to prevent drills or chisels from clogging. The air attachment is said to increase the tool's working capacity in rock drilling by almost fifty percent.

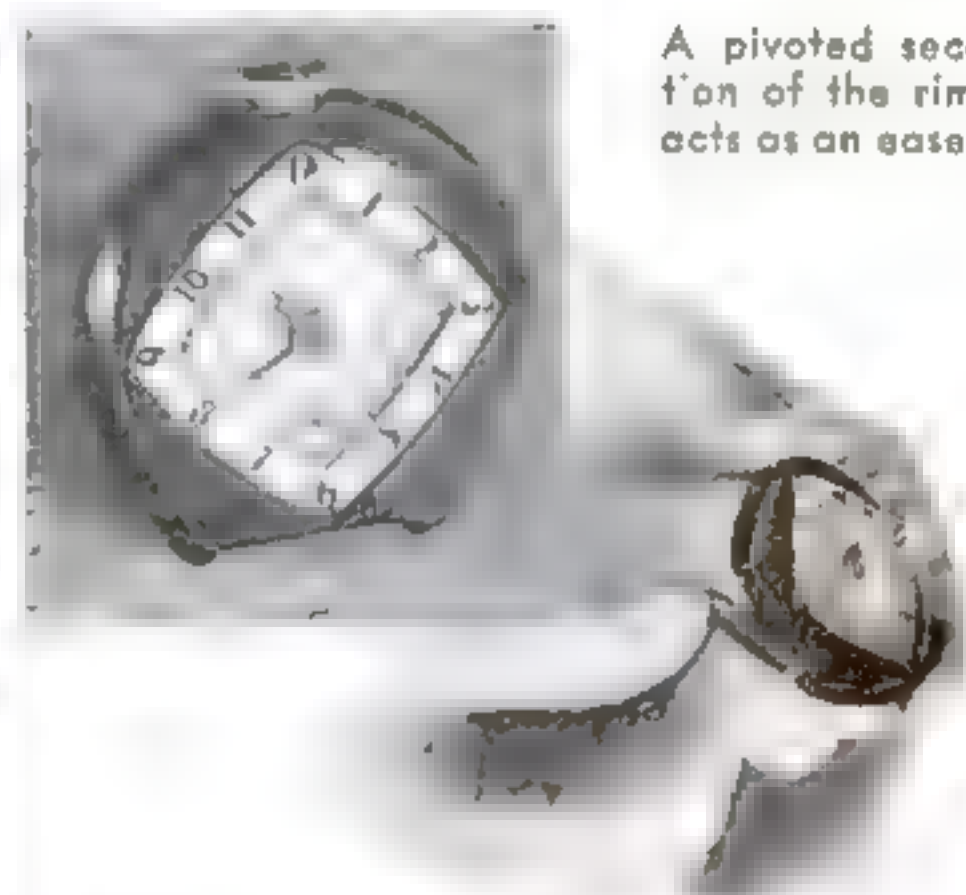


A flexible tube carries compressed air to clear drill hole

Suede-Shoe Brush Has Two Sides



A NEW brush for cleaning suede shoes has sandpaper on one side and sponge rubber on the other. The former roughs up worn or shiny nap, and the other removes spots and returns the original surface to the shoes.



A pivoted section of the rim acts as an easel

Timepiece Combines Watch and Clock

A HANDY timepiece now available serves either as a pocket watch or as a desk or bedside clock. The bottom section of the watch rim is pivoted at one edge so that it can be turned to form a support for holding the timepiece upright.

New Highways Save Gas

AUTOMOBILE drivers can cut their fuel consumption as much as one third by using express highways where few stops or slowings down are necessary, German experts declared after tests.

Trailer School

TEACHES DRIVING and HOUSEKEEPING



OFFERING a comprehensive two-weeks course, what is believed to be the world's first school for trailer owners has just been established on the outskirts of New York City. Staffed by a faculty of experts, the unique school provides instruction in all phases of trailer operation, construction, and maintenance.

The course begins in an indoor classroom where present and prospective trailer owners hear lectures, watch demonstrations, and receive their first lessons in driving with model automobiles and trailers that are maneuvered by hand on a table-top driving area. The curriculum progresses to the study of trailer chassis, lighting systems, brakes, springs, hitches, and other construction details.

As part of the course, visits are made to an actual trailer factory, where units are observed in all stages of construction and assembly. Under the guidance of experts, practical instruction in straightaway driving, backing, leveling, parking, and hitching is given on the open road.

A domestic-science teacher gives lectures on all phases of trailer housekeeping from cooking a banquet on a diminutive stove to the problems of refrigeration, hygiene, menus, and even taking a bath in cramped quarters. Valuable tips are given on planning routes, selecting camps, and choosing space-saving accessories.



A scene in a classroom of the trailer driving school in New York City. Here students begin the course by listening to lectures on the theory of trailer construction and operation. Later they go out in the school's trailer, visit roadside camps, and inspect a trailer factory.

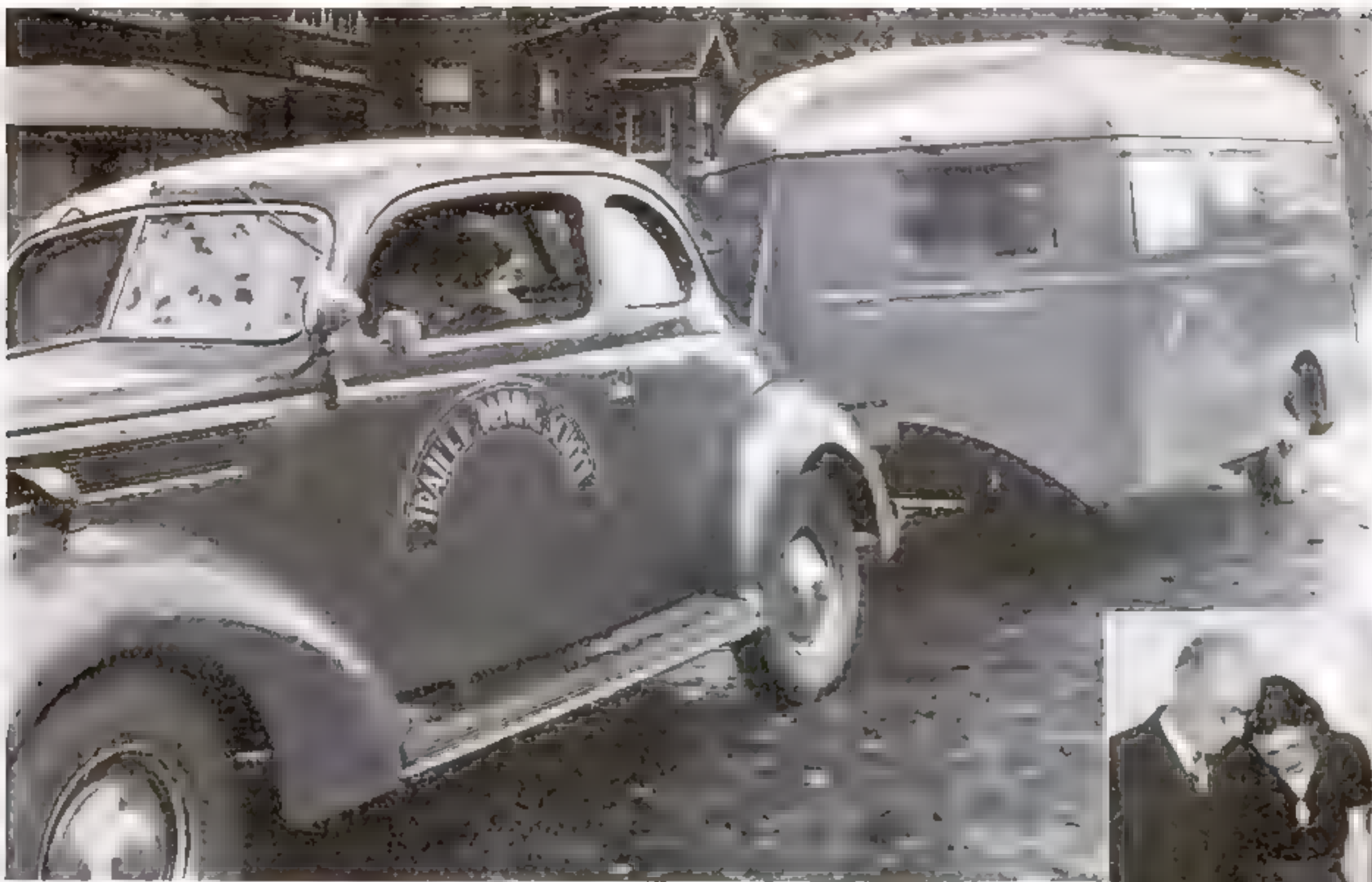
Taking a bath in a trailer is an art in itself. At left, a demonstration of how it's done.



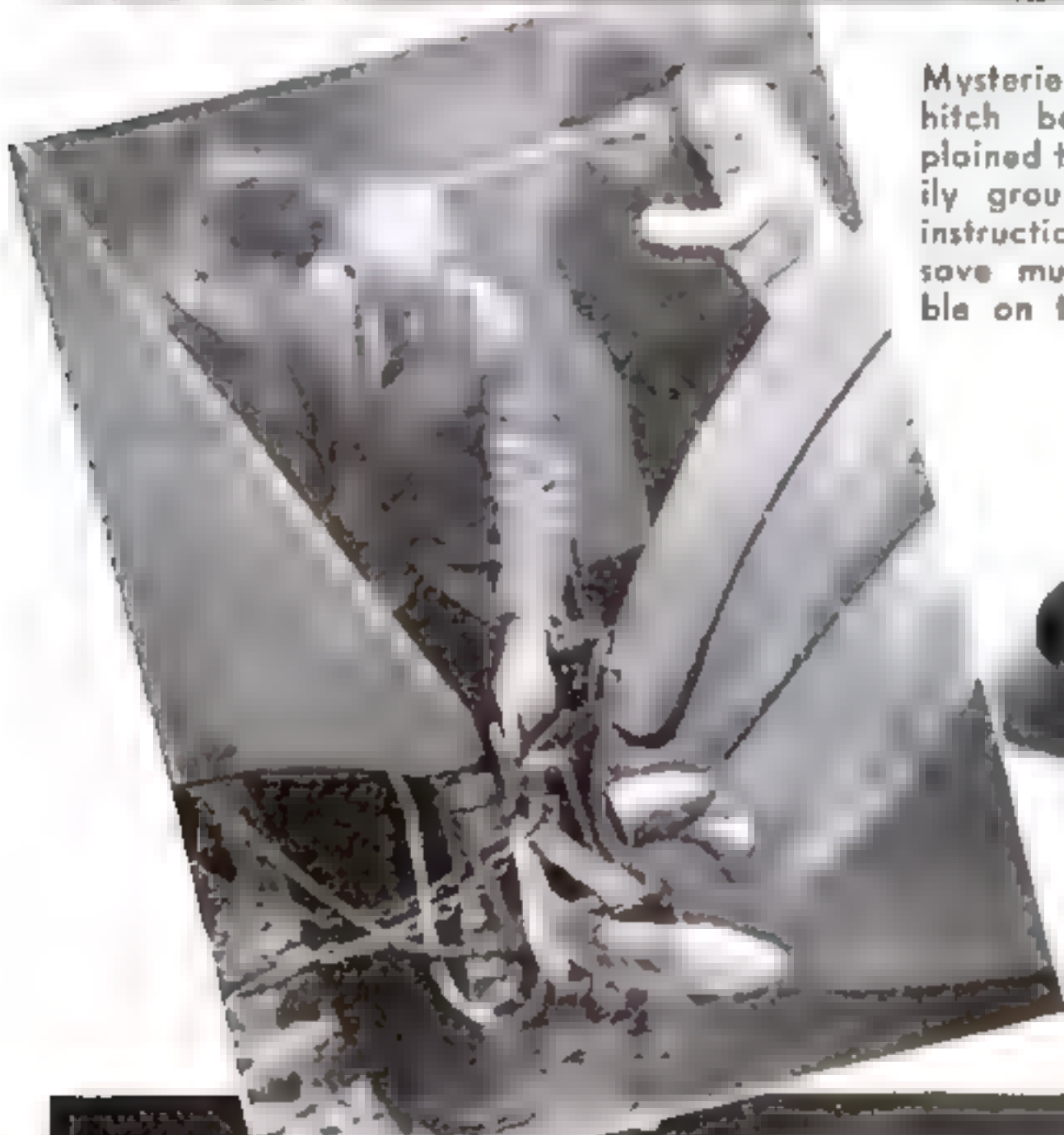
Future trailer housewives learning the practical details of preparing a meal in a trailer galley. Cooking, refrigeration, sanitation, and labor-saving devices are covered in this part of the curriculum.

Below, Mrs. H. T. Eaton, domestic-science instructor at the trailer school, gives a lesson in wash-day technique. The clothesline is tied to a convenient tree.





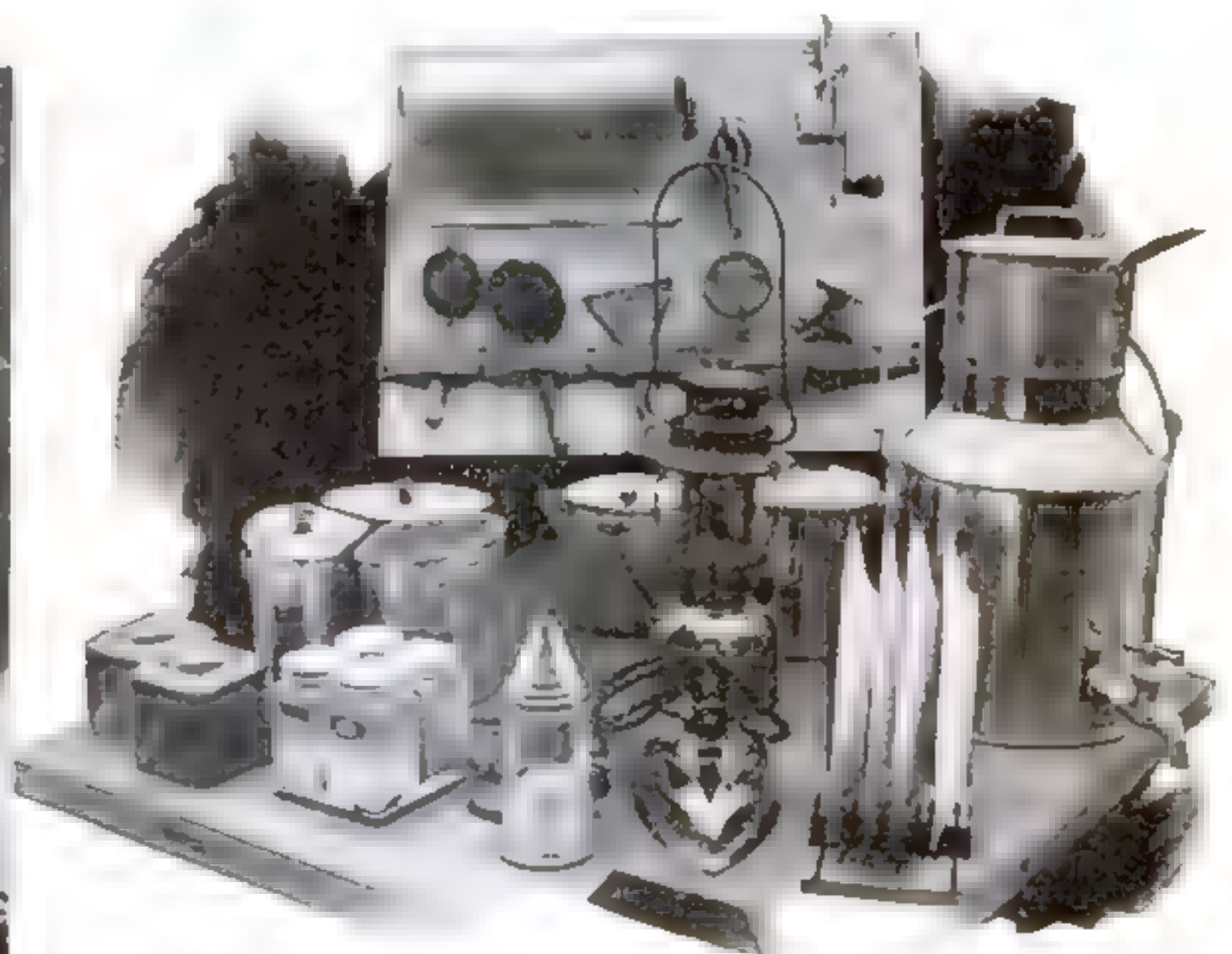
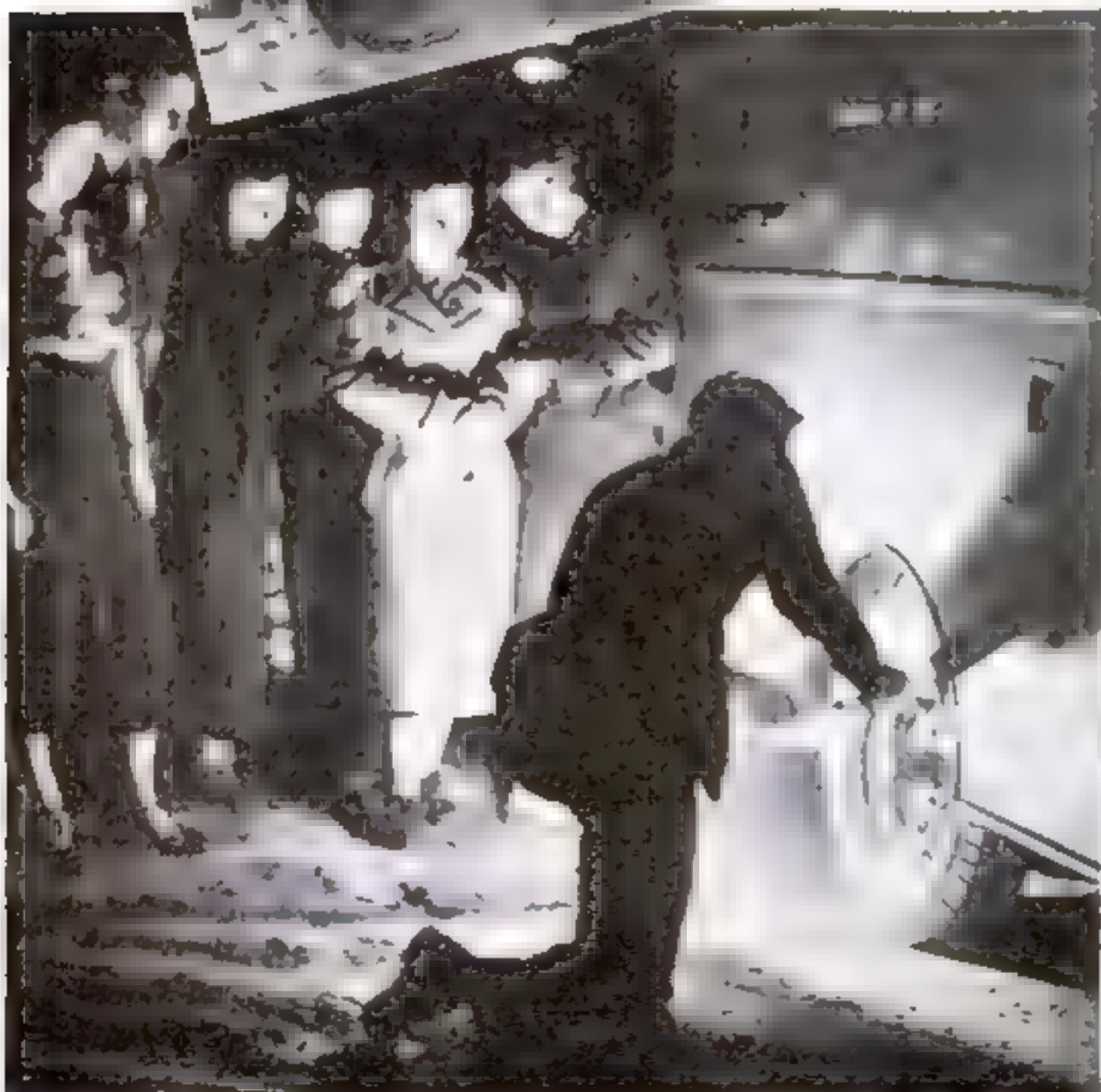
A student getting the "feel" of a trailer with the school's own training unit. Actual practice in straight-away driving, backing, parking, leveling, and negotiating traffic is given in an area allotted for the purpose by the police. Four forty-five-minute periods are devoted to this practice



Mysteries of the hitch being explained to a family group. Such instruction may save much trouble on the road

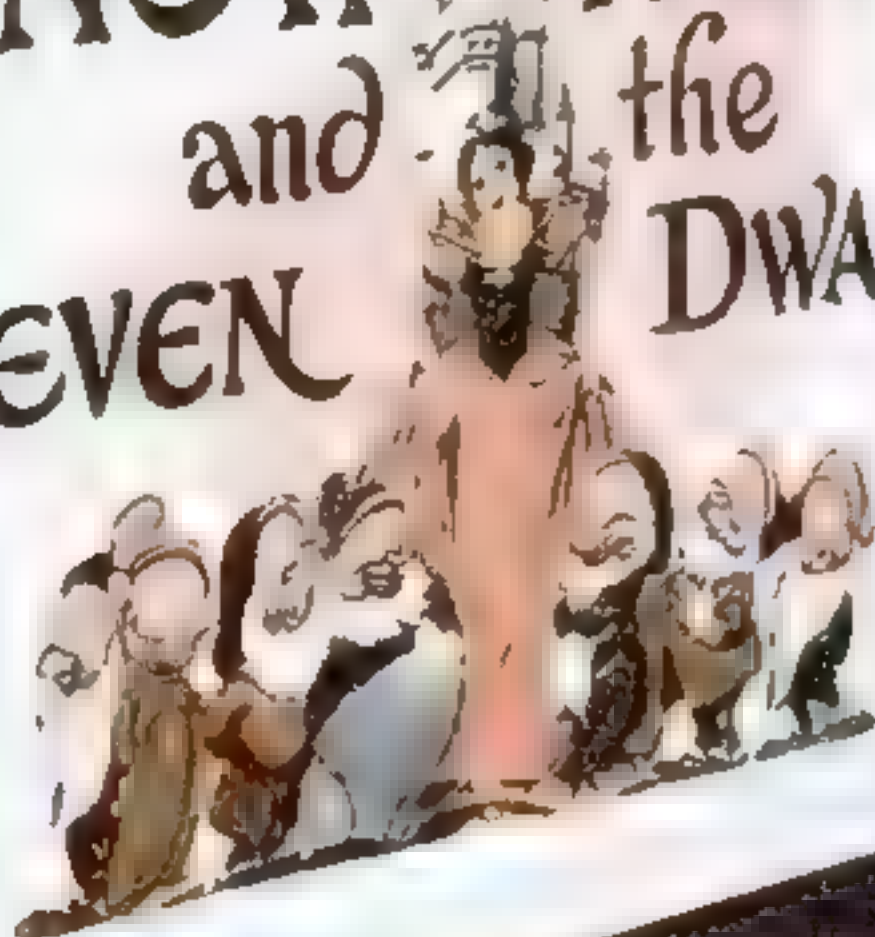


Preliminary driving lessons are given on this model course with miniature cars and trailers that are guided by hand. The course is a scale reproduction of the area used later in practice. Left, a model unit with real steering gear, removable wheels, and differential



An exhibit of typical trailer accessories, designed to help students plan their own equipment. Note the rack with rubber strip to hold small articles. At the left, an instructor is showing how to change a tire at night in the light of a flare

SNOW WHITE and the SEVEN DWARFS



By ANDREW R. BOONE

BEHIND the black walls of an air-conditioned Hollywood studio laboratory, the shutter on a strange eight-deck camera flicked open and shut the other day, exposing the last of 362,919 frames of color film. At that instant was completed the first feature-length motion-picture cartoon ever created, one requiring more than 1,500,000 individual pen-and-ink drawings and water-color paintings. Also, at that moment, depth, a sense of perspective and distance hitherto seen only in "live action" pictures, sprang into being for cartoons.

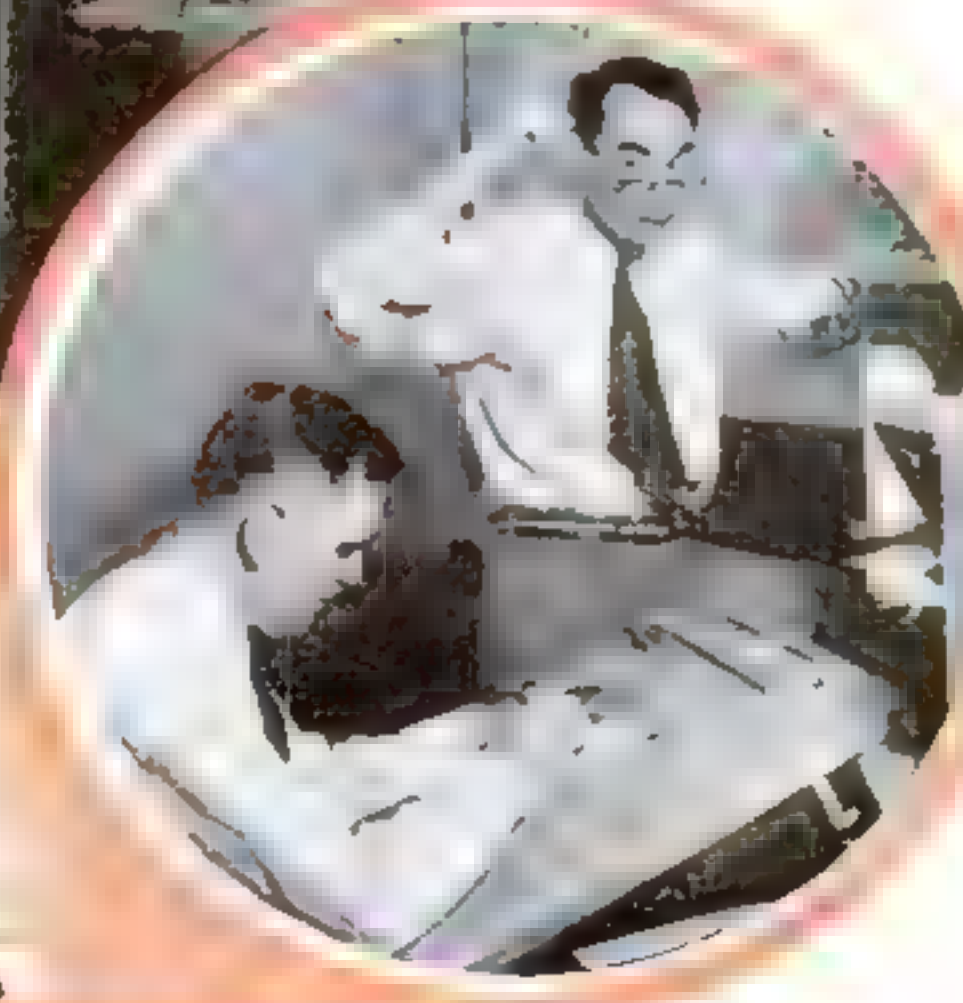
Both the giant camera and the picture had their beginnings in a decision made four years ago by Walt Disney, famed creator of Mickey Mouse and Donald Duck, to produce a feature based on a well-known folk tale. "Snow White and the Seven Dwarfs," a movie version of Grimm's famous fairy tale filmed by the multiplane camera, is the result.

Heretofore, movie cartoons have been series of photographs of drawings and paintings on oblong pieces of celluloid held in a single plane. That is, when photographed the "cels," or transparent sheets bearing the drawings, were stacked like pieces of paper. On each was painted a part of the scene reaching the screen.

Disney wanted to increase the eye value of the many paintings making up a picture by achieving a soft-focus effect on the backgrounds, illuminating the various



One of the special cameras used to photograph figures drawn on celluloid against a painted background. At right, an animator is drawing a cartoon character as a helper poses for him



levels of each scene individually, and separating background from foreground, thus keeping background objects to their proper relative size.

His production crew labored for three years to perfect the novel picture-taking device to achieve these results. It consists of four vertical steel posts, each carrying a rack along which as many as eight carriages may be shifted both horizontally and vertically. On each carriage rides a frame containing a sheet of celluloid, on which is painted part of the action or background.

Resembling a printing press, the camera stands eleven feet tall and is six feet square. Made with almost micrometer precision, it permits the photographing of foreground and background cels accurately, even when the first is held firmly in place two feet from the lens and the lowest rests in its frame nine feet away. Where the script calls for the camera to "truck up" for a close-up, the lens actually remains stationary, while the various cels are moved upward. By this means, houses, trees, the moon, and any other background features, retain their relative sizes.

When everything is ready for action, an operator takes his place at each level of the camera, adjusting the cel, lowering or raising it, top-lighting or back-lighting his part of the scene as required. Also, by moving all cels except those on which the characters are painted across-camera at the same speed, the illusion of distance is created.

Unlike live action color photography, in which the camera records the primary colors on three negatives in a single exposure (P.S.M., May 1935, p. 13),

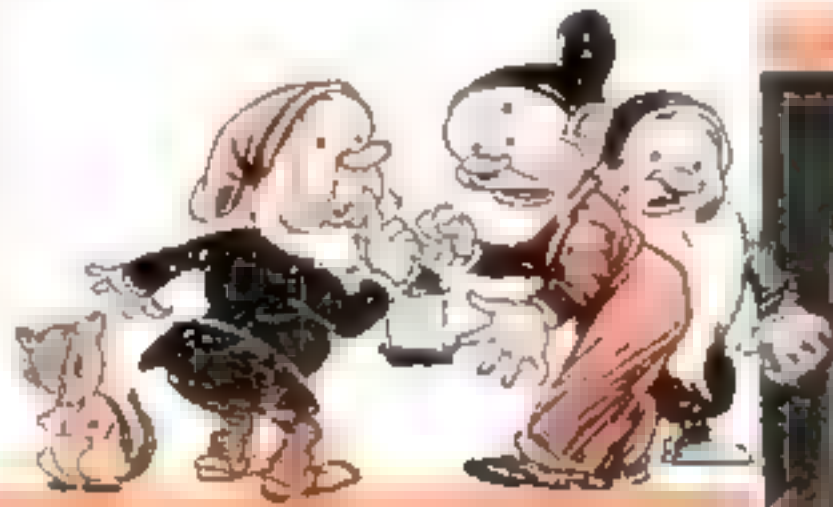
in making cartoons in color the camera makes three exposures on each set of cels, recording red, green, and blue separately. Thus, to complete the 7,560-foot picture, film totaling three times that length was required. Later, a print of each color was made and the three were printed, one over the other, on a single negative.

Long before the picture reached the camera, however, artists completed tens of thousands of drawings. Animators worked for six months, drawing innumerable pictures, before they caught the spirit of the various characters they were expected to portray and were able to set down that spirit, without variation day after day. Five hundred voices were tested, that nine might be selected to fit the personalities being established by the artists. Sound men experimented with odd devices, crashing glass, tumbling boxes to the floor, walking in mud—seeking noises that would fit the action. Colors, portraying characters and moods, were selected.

In cartoons, all sounds are recorded before the cameras begin to turn. These sounds are later synchronized with movements and



A girl artist tracing a picture of Snow White on celluloid from a paper original



Background artist at work on settings to match the moods of cartoon characters in the various scenes

Right, a girl in the paint department mixing colors to be applied to celluloid by the 140 girl artists. Each tint must conform to specifications



The monster camera in action. The inset shows how it photographs figures on celluloid sheets at various levels to suggest distance





A sheaf of "cels," or transparent sheets bearing pictures, each of which represents a separate movement of Snow White during the singing of a song. Seen in rapid succession, they give an effect of motion



speaking, and the director followed a prescribed tempo in wielding his baton. Each syllable, each musical note, started on a musical beat and ended on a musical beat.

Graphs of the voices, with the words uttered, were delivered to the artists who, studying the graphs and listening to the voices, created the action, forming mechanically with pen-and-ink lips the words being played back to them.

When an animator drew the various lip movements required to form a word, he frequently consulted the sound track, to know precisely in how many frames he must complete the drawings. When the dwarfs tumbled into dishes and glassware, knocking them crashing to the floor, he listened to the sound film that he might synchronize the pictures to the noise.

Sound presents a constant problem to the cartoon maker, for he cannot store noises on film in concrete vaults for future use, as in the case of live action. Here, again, he must match action and noise, frame by frame.

In one scene, one of the dwarfs climbs the stairs, becomes frightened, and the six other dwarfs, taking fright, run pell-mell into the dishes. Falling crockery sounds like something entirely different through a loud speaker, so the sound crew carefully stacked an assortment of boxes on the sound stage, hung the mike (Continued on page 131)

charted on the basis of units of time. Since twenty-four "frames," or separate pictures run through the projector every second, action and sound effects must be timed accordingly. Each beat of music is timed by an electrical metronome, and everything else is related to these beats.

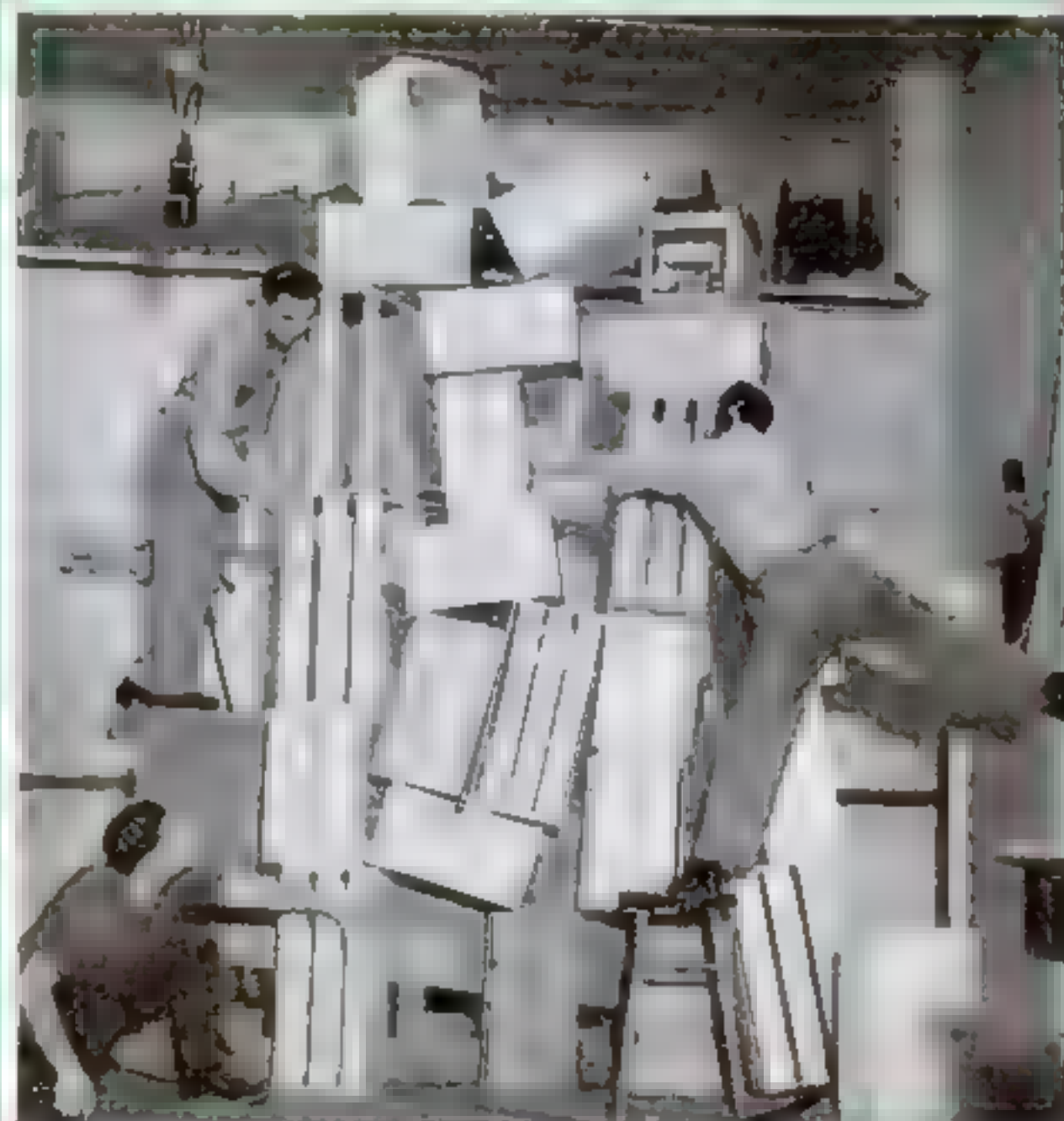
Because the action must parallel sound to the fraction of a second, a work chart was prepared for the entire

feature. Each drawing carried notes to guide the artists in their work, and their drawings later were spaced so as to agree. From the chart, artists, cartoonists, and sound men followed, frame by frame, to build their parts of the picture.

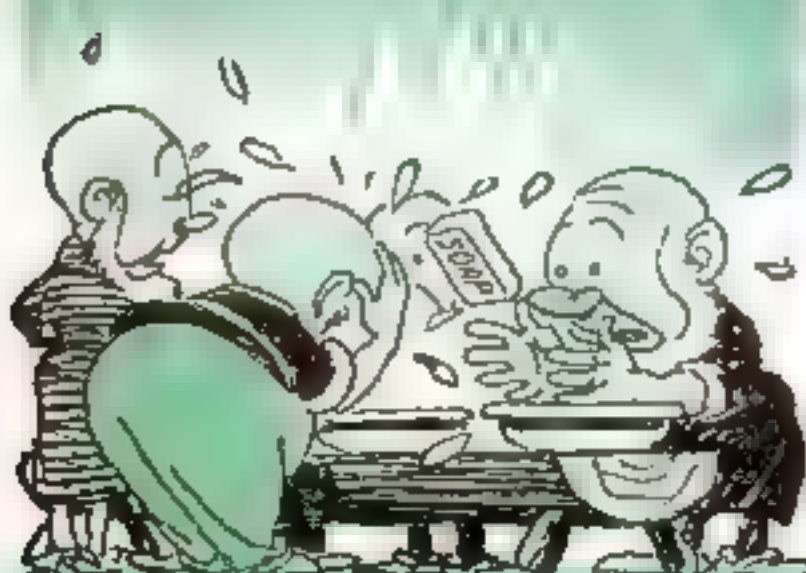
Recently, I watched actors and musicians, all fitted with earphones, as they recorded dialogue and music. Actors followed a rhythmic pattern in



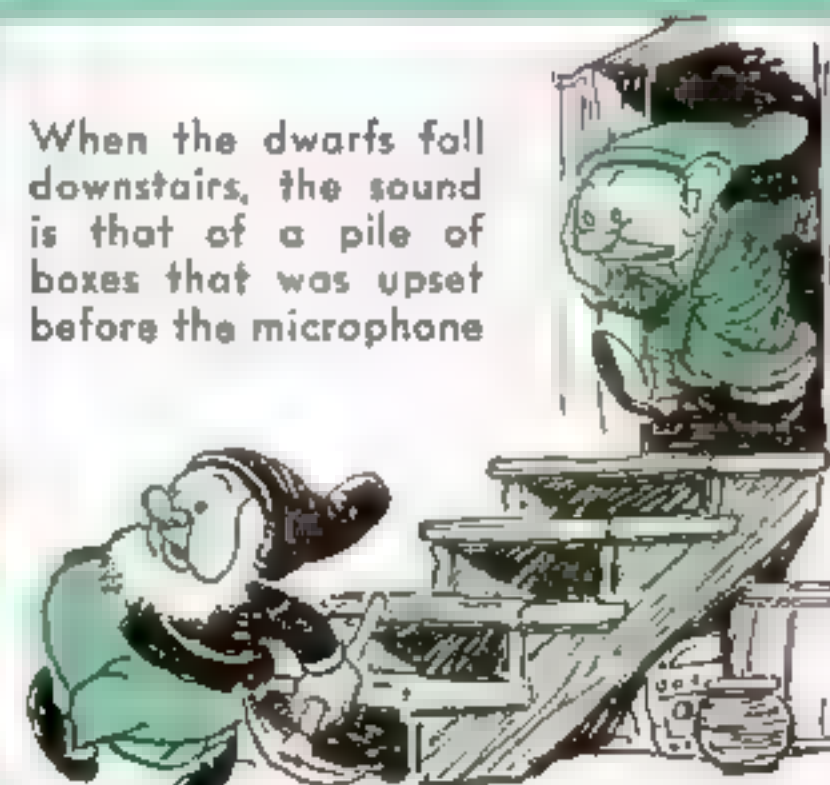
To represent the voice of a talking mirror, an actor stuck his head in a frame covered with old drumheads and spoke



The noise of seven dwarfs washing their faces was produced by seven sound-effects men splashing their heads in a tank of water, and even singing with their faces under the surface



When the dwarfs fall downstairs, the sound is that of a pile of boxes that was upset before the microphone



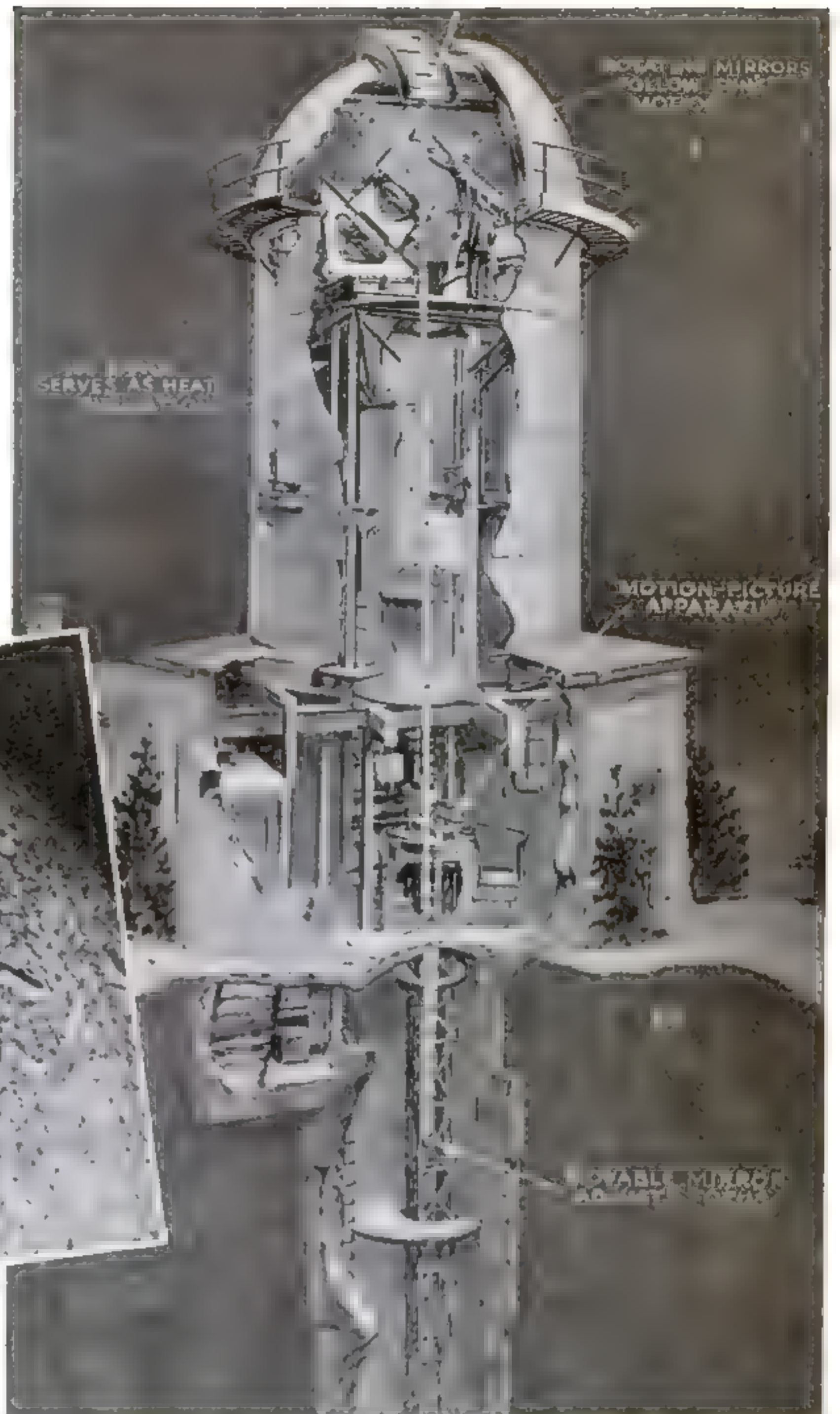
Tower Telescope Takes Movies of the Sun

SUNK into the ground at its lower end, a fifty-foot tower serves as a telescope for photographing the sun in what is said to be the only observatory in the world equipped for making motion pictures of all the heavenly bodies. Operated near Detroit by the University of Michigan, the observatory has an arrangement of motor-driven, revolving mirrors that continually face the sun and reflect its image down the length of the tower to observation and photographic instruments below. The magnifications obtained are so great, it is said, that pictures are usually made only of a small portion of the sun's surface to show prominences, spots, and other phenomena of the fiery sphere. Mere swellings of solar material, without actual eruption, have been shown by the camera to rise for distances of more than 43,000 miles from the surface of the sun.

Spots on the sun, as seen through giant telescopes

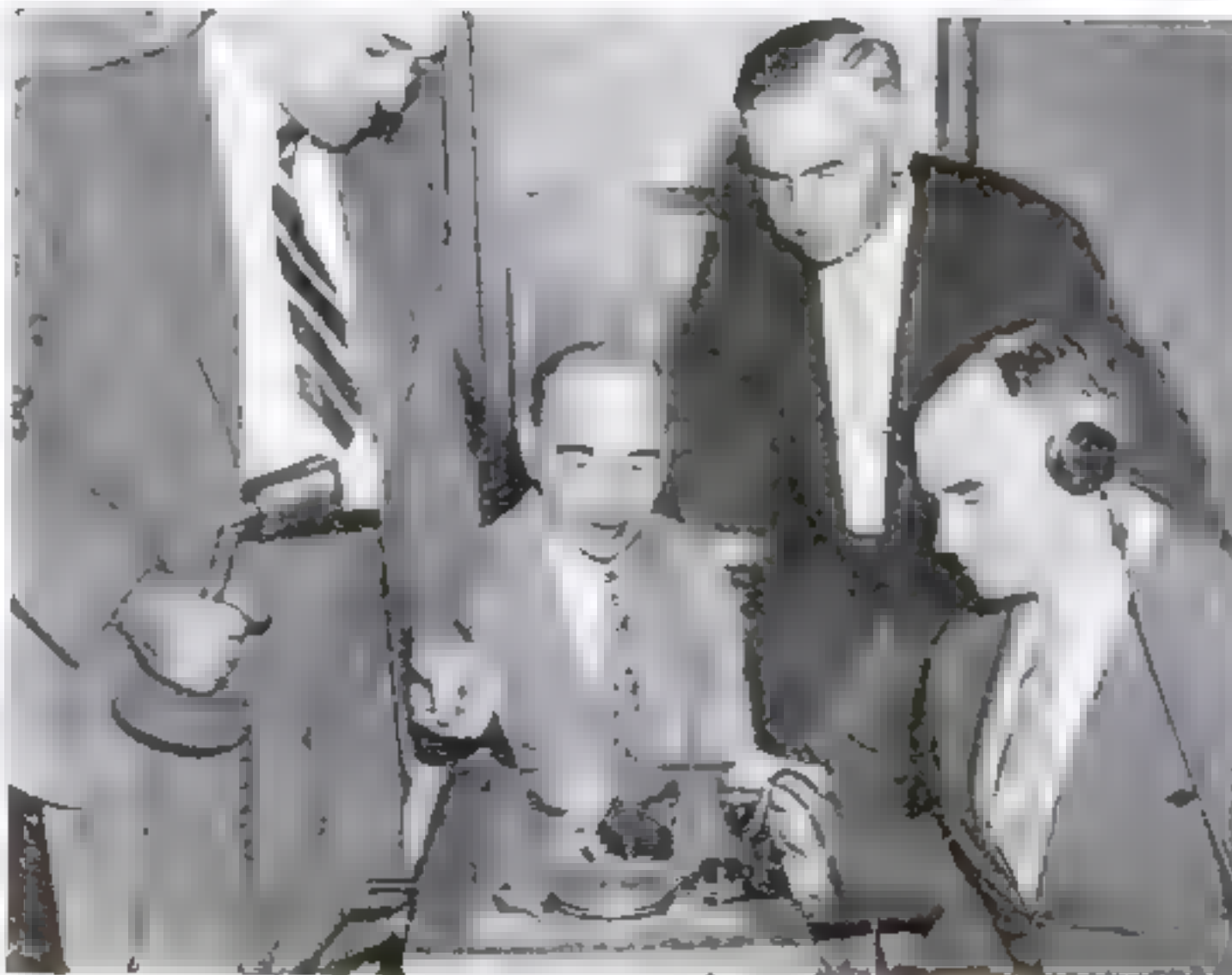


Cut-away view of the tower. Moving mirrors at the top catch the image of the sun

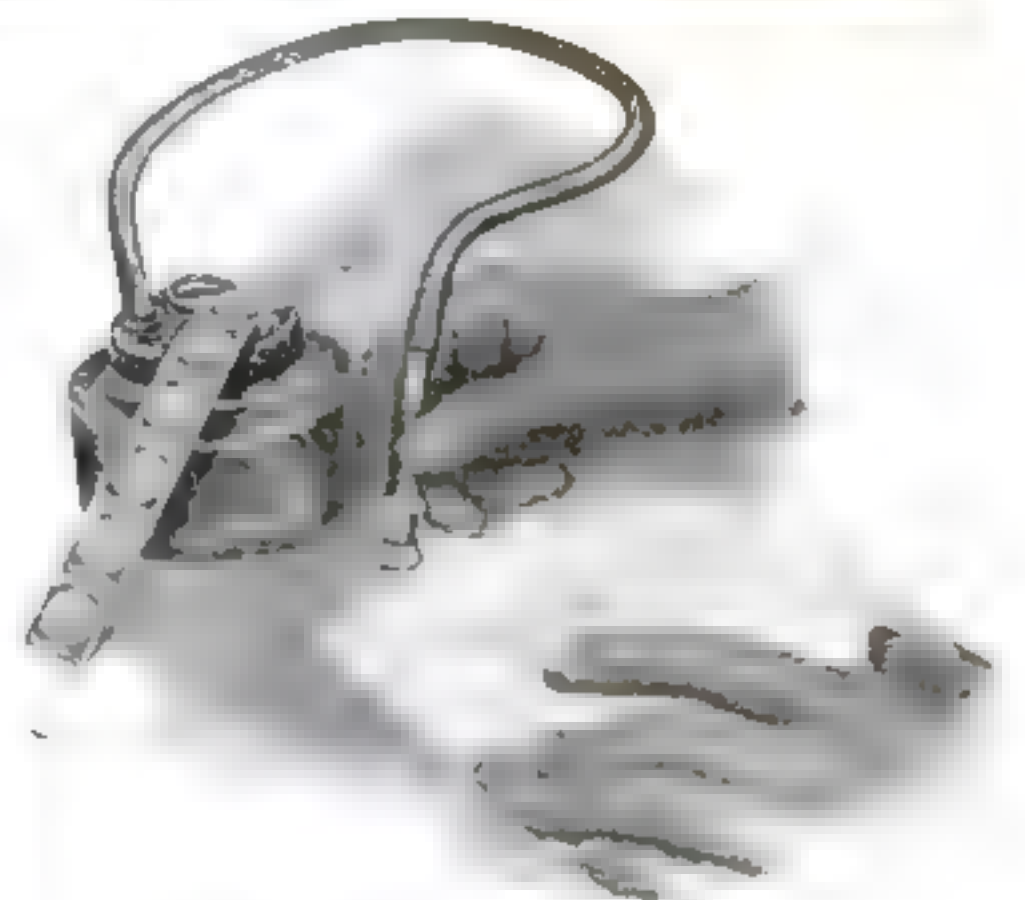


Magnets Make Sound Record on Steel Tape

SOUNDS are recorded and reproduced magnetically by a new system developed in New York by Bell Telephone Laboratories engineers. Electromagnets are employed to make a magnetic sound pattern on thin steel tape, which can be used to reproduce the original sound immediately after recording, no processing being necessary as is the case with wax disk records. The steel tapes withstand repeated playing with little or no deterioration.



Experimenters listening to sounds recorded on steel by magnetism



Desk Well Licks Stamps

RESEMBLING an inkwell, a handy desk accessory serves as a moistener for stamps and envelope flaps. Stamps are drawn across a roller in the water-filled unit, while envelope flaps are moistened by means of a tiny brush on the end of a rubber tube.

Dare-Devil To Cross English Channel by Parachute



French airman with oxygen equipment and spare parachute to be used in an attempt to drift across the English Channel. Below, a test landing

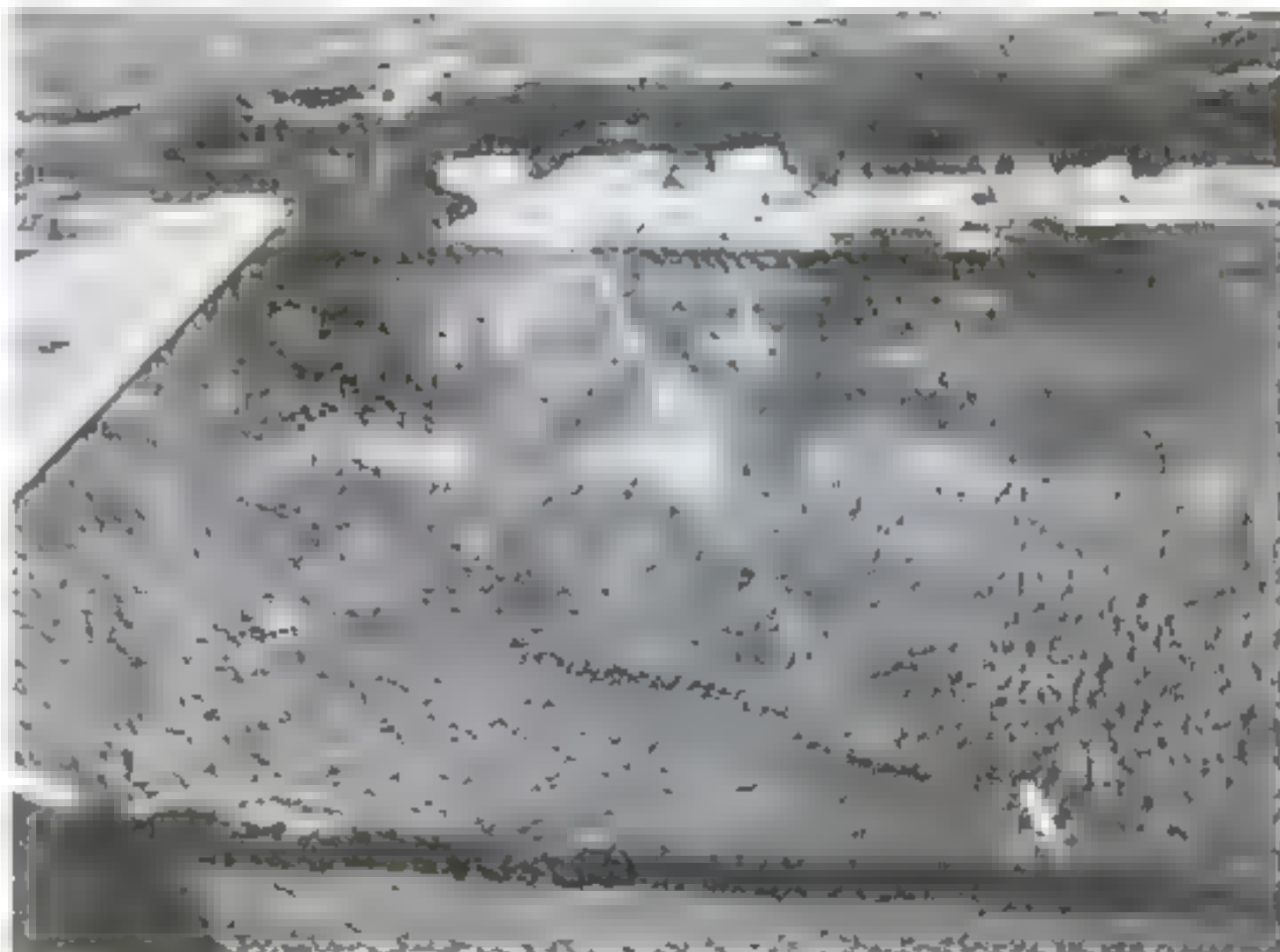


EQUIPPED with special breathing apparatus for use at high altitudes, a French dare-devil recently conducted tests for a projected crossing of the English Channel from England to France by means of a parachute. Leaping from a plane that has climbed to a great height, he plans to drift across to the French mainland on a prevailing westerly wind. A second parachute will be strapped to his chest for emergency use in case the first fails to open.

Aerial Camera Spots the Mason-Dixon Line



MASON AND DIXON'S line, part of the boundary between free and slave states before the Civil War and traditional division between the North and South, is clearly visible as a white streak in the photograph at the right, made from a U.S. Geological Survey plane. The historic line, run in the 1760's as the boundary between Pennsylvania and Maryland, shows up where it cuts through a patch of woods.



The white streak is the historic Pennsylvania-Maryland boundary

Bottles Can Be Stacked To Save Storage Space

GLASS bottles, constructed so that the neck of one fits snugly into a depression in the bottom of another, are a recent invention of William Fehr, of Sacramento, Calif. Bottled beverages and foodstuffs thus can be stacked in compact columns to save storage space in refrigerators or on pantry shelves.

Smoke Matches Gowns

CIGARETTES that give off colored smoke are a recent invention of Otto L. Miller, of Memphis, Tenn. Any desired shade of smoke can be produced, the inventor declares, and women can select hues to match the color of their gowns or costume accessories.



Artillerymen training a gun on a model tank dragged in front of them

Army Gunners Practice Aim on Toy Tank

WHEN tanks are not readily available for sighting practice, U. S. Army gunners use a toy reproduction as a substitute. Since the guns are merely aimed and not fired, a soldier drags the model tank across an open field in front of the artillerymen, as shown in the photograph at the left.



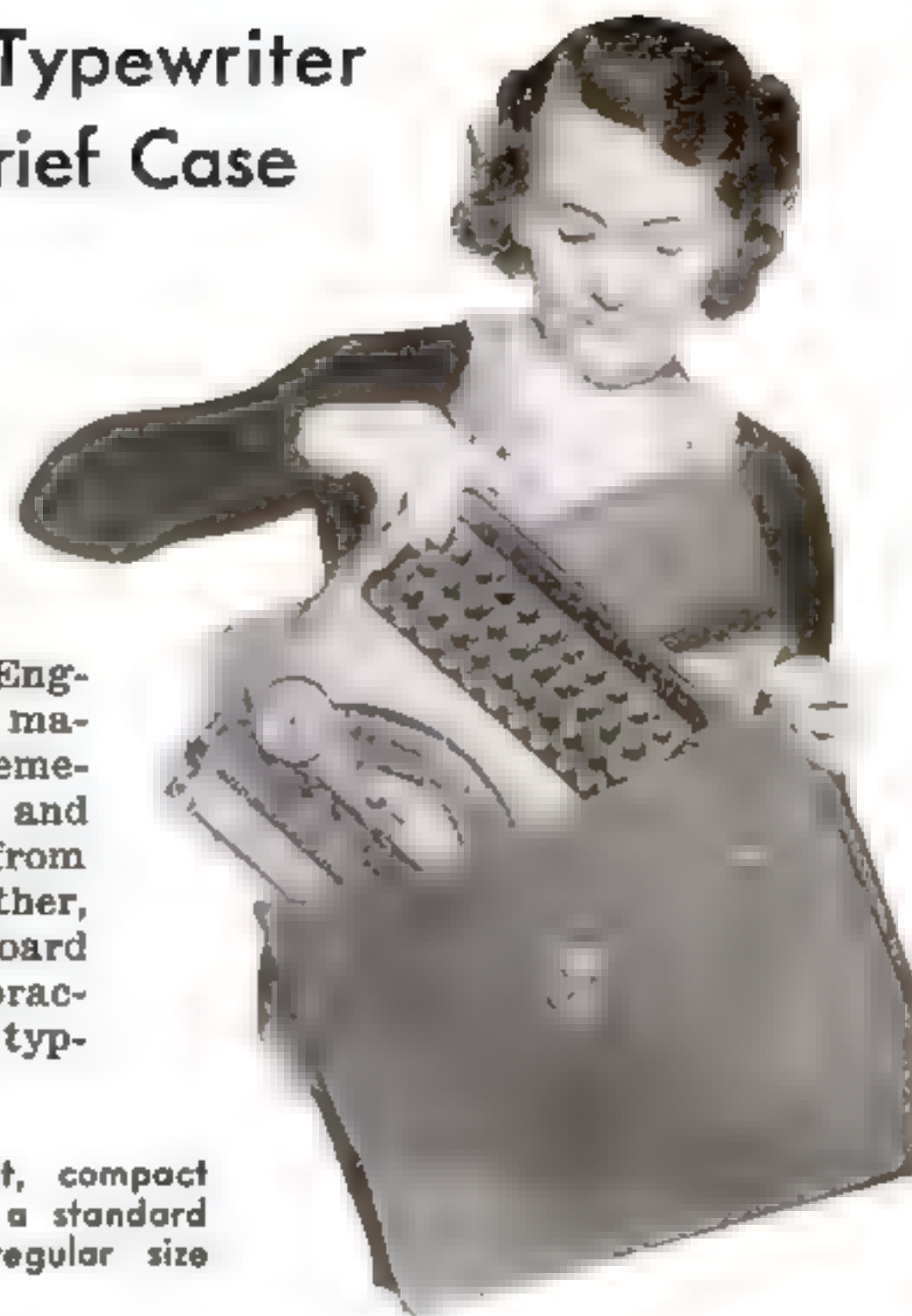
Velvet Is Tested as Shoe Soles

TO PROVE the wearing quality of a new velvet upholstery fabric, a textile manufacturer recently made the novel experiment of having employees wear shoes soled with the material. The curious shot of the velvet-soled shoes shown above, was snapped by a photographer from a point of vantage beneath a platform fitted with a top consisting of a thick sheet of plate glass.

Diminutive Typewriter Goes in Brief Case

SO SMALL, that it can be carried easily in an ordinary brief case, the diminutive typewriter shown in the photograph at the right was recently displayed at an exhibition in London, England. The compact machine, although extremely light in weight and easy to carry around from one location to another, has a full-size keyboard and can be used for practically all kinds of typing work.

This lightweight, compact typewriter has a standard keyboard of regular size



Safety Ash Tray Grips Cigars or Cigarettes



V-SHAPE notches hold lighted cigars or cigarettes over the center of a new foolproof ash tray, so that if forgotten they will fall inside the container. Lifting the lip of the tray allows ashes or butts to drop into an inner chamber. The receptacle is made of a lightweight plastic material.

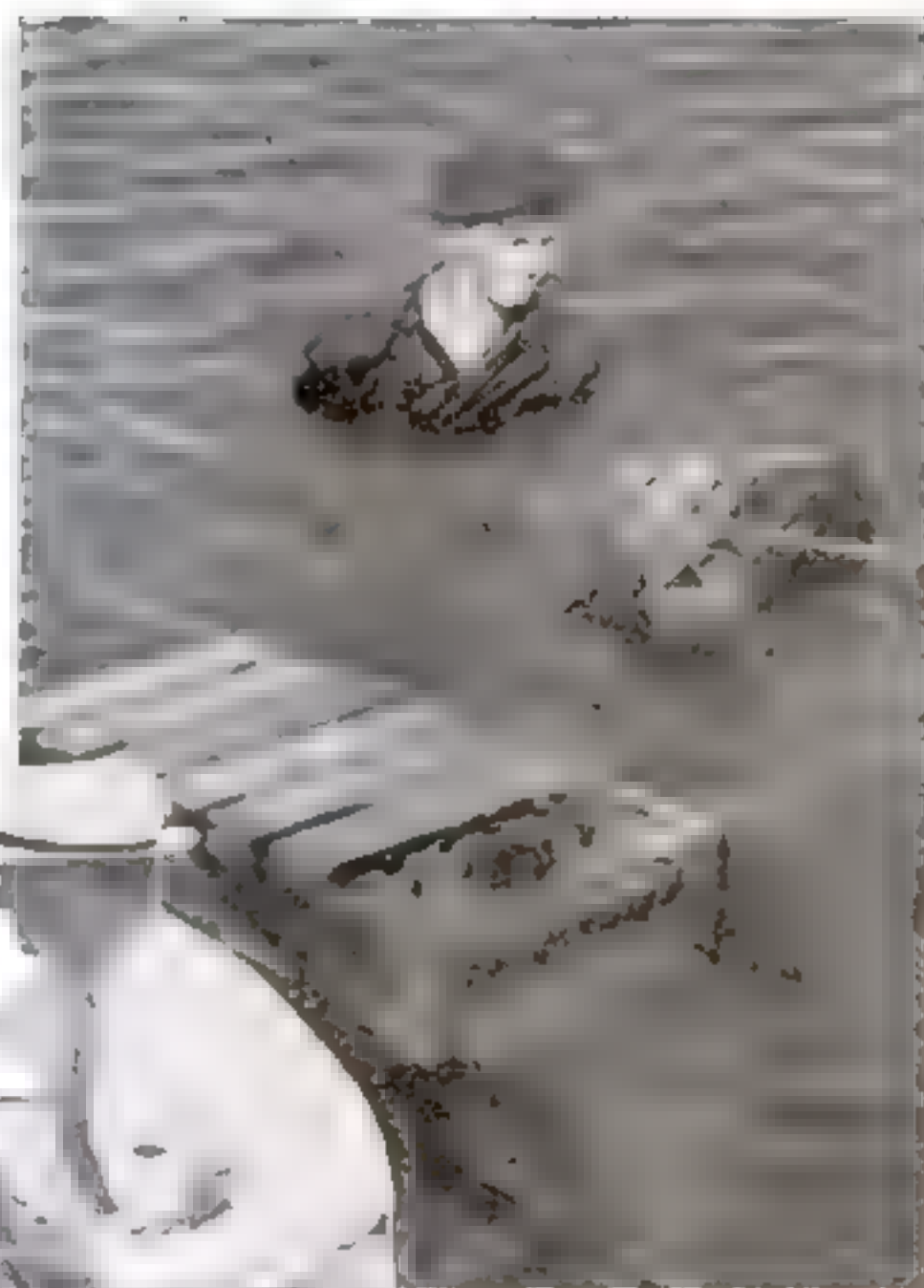


New Chemical Process Waterproofs Cloth

A CHEMICAL that makes textile fabrics permanently water-repellent has just been developed by Du Pont chemists. Especially adapted for use on cottons and linens, the compound leaves the cloth with a soft finish and will not wash out.

Alkali Lake Is Proving Ground for Concrete

THOUSANDS of small concrete cylinders, neatly stacked in sturdy crates, were removed recently from the waters of Medicine Lake, near Watertown, S.D., where they had been submerged for periods varying from one to ten years. The highly alkaline water of the lake served as a proving ground to show the deteriorating effect of alkalis on concrete mixtures commonly used in building dams, sewers, and water pipes. Using data obtained as a result of these tests, engineers have discovered effective methods of increasing the alkaline resistance of concrete.



Crates containing concrete specimens being fished out of the lake



At left, experts are examining samples for signs of deterioration

Mobile Power Plant Aids Cameramen

Cameras and lighting equipment can be rushed to news events in this speedy truck



DEVELOPED for motion-picture work at night or under bad lighting conditions, a mobile power unit mounted on a truck provides adequate lighting in locations where electric current is not

available. Flood lights can be mounted on the railed top, while photographic equipment is carried in interior compartments. A gasoline engine drives a generator of 40,000-watt capacity.

Electric-Eye Device Grades Flour Samples



Photo-electric cells actuate the unique flour-testing device

A COMPACT electrical instrument just perfected by a Russian scientific-research institute tests and grades the quality of flour. Utilizing a set of photo-electric cells, the apparatus is said to make it possible to determine accurately and within the short space of five minutes, the exact amount of bran that is present in any given sample of flour. A graduated dial automatically indicates the analysis of the flour under examination.

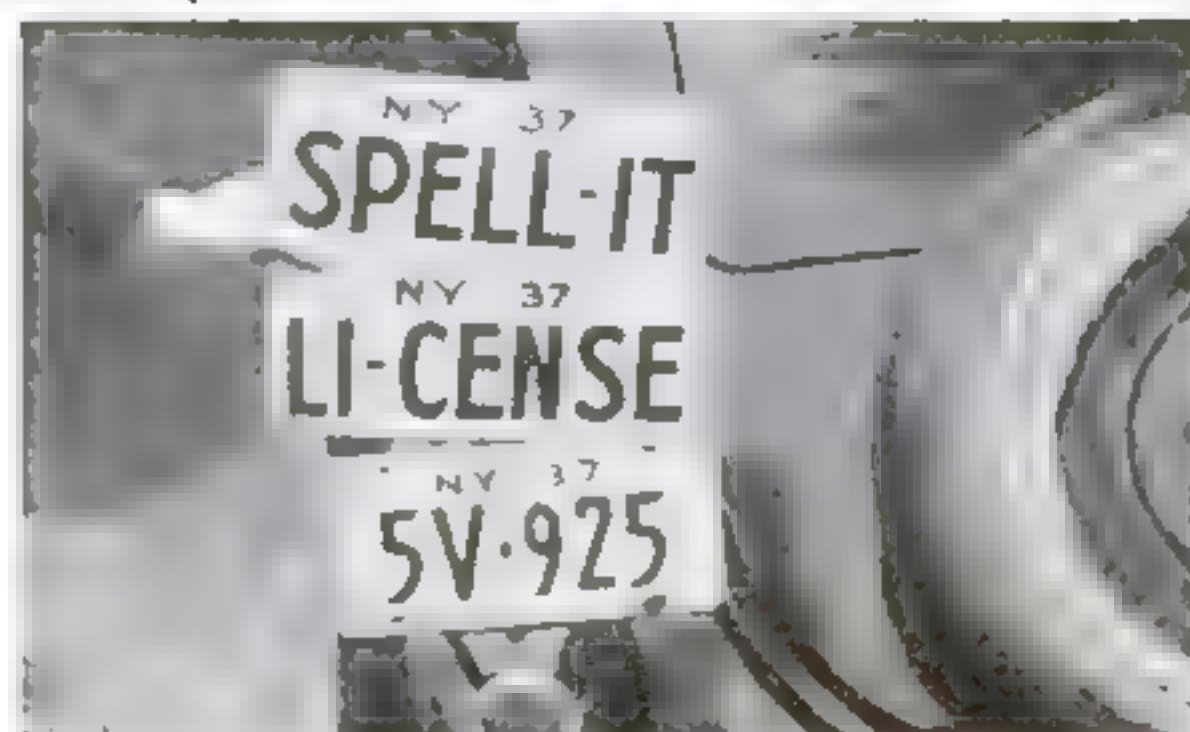
Cigarette Holder for Nudists

FACED with the problem of carrying cigarettes when no pockets were available, a delegate to a recent nudist convention devised the holder shown at right. The leather case is strapped to the leg by means of an elastic band.



Words, Not Numbers, Grace New License Plates

NAMES, abbreviations, and short words, real or made up, replace numerals on a new form of license plate proposed by Walter W. Hinton, of New York City. By using actual words on car plates, the inventor believes, they will be easier to read, and will make a distinct impression on the mind, thereby making them easier for owners and others to recall.



The owner's name could be used on these automobile tags



Acrobat Dangles from Tower by His Toes

CLINGING to a rope by his toes, a French circus acrobat was recently lowered head downward from a rooftop crane on the belfry of the town hall of Lille. On the ascent, he was hauled up as he gripped the rope with his teeth. The daring acrobat, shown above during his trip down, is planning to repeat his breath-taking performance in London on the clock tower of the British Houses of Parliament for the benefit of an English audience, if permission can be obtained.

Waterproof Typewriter Gets Tests



Spraying water directly on the machine to prove it is waterproof

TO SHOW that rain, snow, or accidental spilling of water will not damage a typewriter now on the market, the manufacturer conceived the odd display shown at the left. Mounted on a pedestal erected in the center of a shallow tank, the machine was subjected to a constant spray of water. The waterproof typewriter is expected to be useful to reporters and others who occasionally use a machine out of doors in rainy or snowy weather.



New Gas Mask Carries Light for Night Use

A BUILT-IN electric light is a new improvement for gas masks designed for wartime use. The bulb is mounted near the top of the mask to cast a light beam similar to that of a miner's lamp. A case that holds batteries and the lighting switch is connected to the mask by a flexible tube.

Cotter Pin Locks Itself

WHEN an improved cotter pin just invented is hammered into position, its legs spread automatically to hold it in place. The new cotter has a member running through its center and beyond the pin head. When this is hit, its forward end forces the turned-in points of the cotter apart as indicated in the drawing at right.



A hammer blow spreads the points

Air-Driven Craft Skims over Water, Ice, or Snow



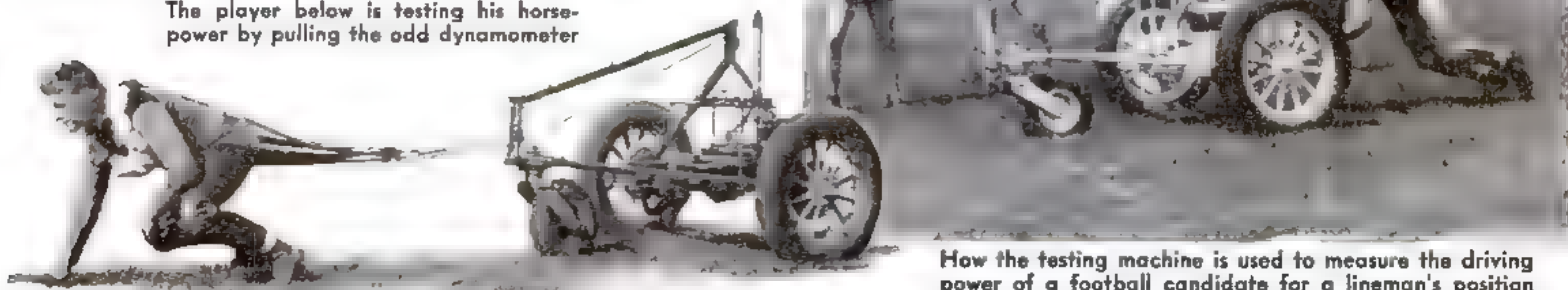
DESIGNED for arctic use, a curious amphibian craft recently completed can operate on water, ice, or snow. Driven by an airplane-type propeller and motor mounted at the stern, the boat is steered by a wind rudder and stabilized by its fin-like

propeller guards. The curving prow of the amphibian and its planing action in the water enable it to slide up onto the ice, where it races along at high speeds on runners of stainless steel, permanently attached to the hull of the craft.

Novel Three-Wheeled Machine Measures Horsepower of Athletes

MOUNTED on a rubber-tired, three-wheeled carriage, a measuring device in use at Purdue University registers the pushing or pulling strength of a man in terms of horsepower. Football players tested with the portable machine showed ratings of from three-quarters to over one and a half horsepower, with the linemen achieving the highest marks.

The player below is testing his horsepower by pulling the odd dynamometer



How the testing machine is used to measure the driving power of a football candidate for a lineman's position

By
STERLING
GLEASON

Martin G. Murray with one of the six seismographs he has built in his back-yard observatory at Huntington Beach, Calif., to record local and distant earthquakes. At the time of the 1933 Long Beach disaster, one of his instruments made records that had great interest for scientists



Amateur Scientist

CHECKS WEATHER AND EARTHQUAKES WITH HOMEMADE INSTRUMENTS



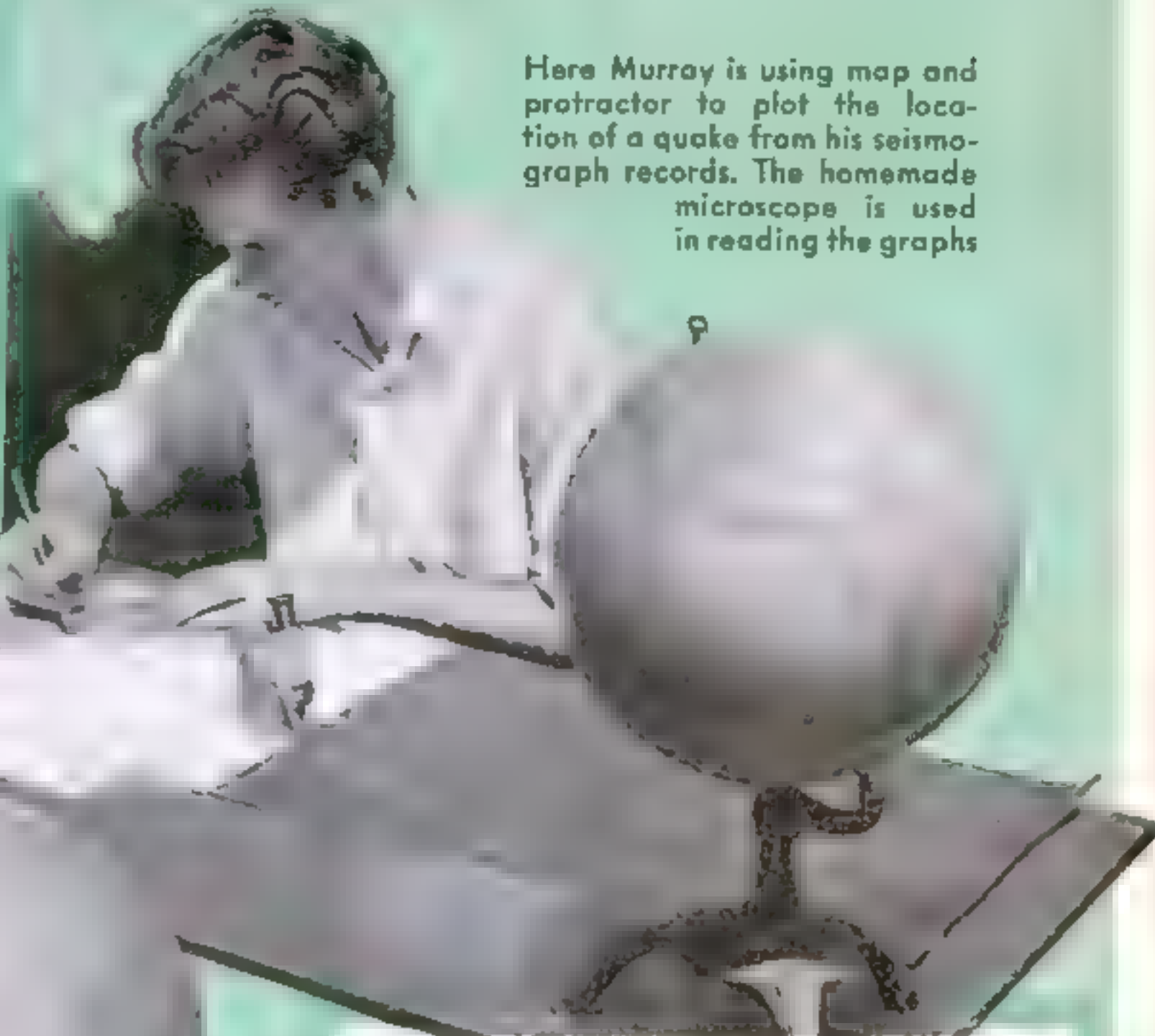
The tube of this homemade telescope is a section of a red-wood water main, well scrubbed and mounted in a universal frame of steel inside an outdoor "roundhouse." Weather writes its own record on rotating circular paper disks in Murray's recording thermometer pictured at the right

WHEN Martin G. Murray sees a scientific instrument that interests him, he goes home and makes one like it for himself. This hobby has filled his back-yard laboratory at Huntington Beach, Calif., with devices that do everything from keeping track of the weather to detecting distant earthquakes. His seismograms have brought friendly correspondence with scientists at famous observatories. He makes his own weather predictions with the aid of daily Government weather maps, plus observations with his own instruments. Occasionally he supplies local data to the U.S. Weather Bureau.





An old airplane altimeter, ingeniously calibrated with a special scale and fitted with a lens for easy reading, forms the accurate homemade barometer at the left



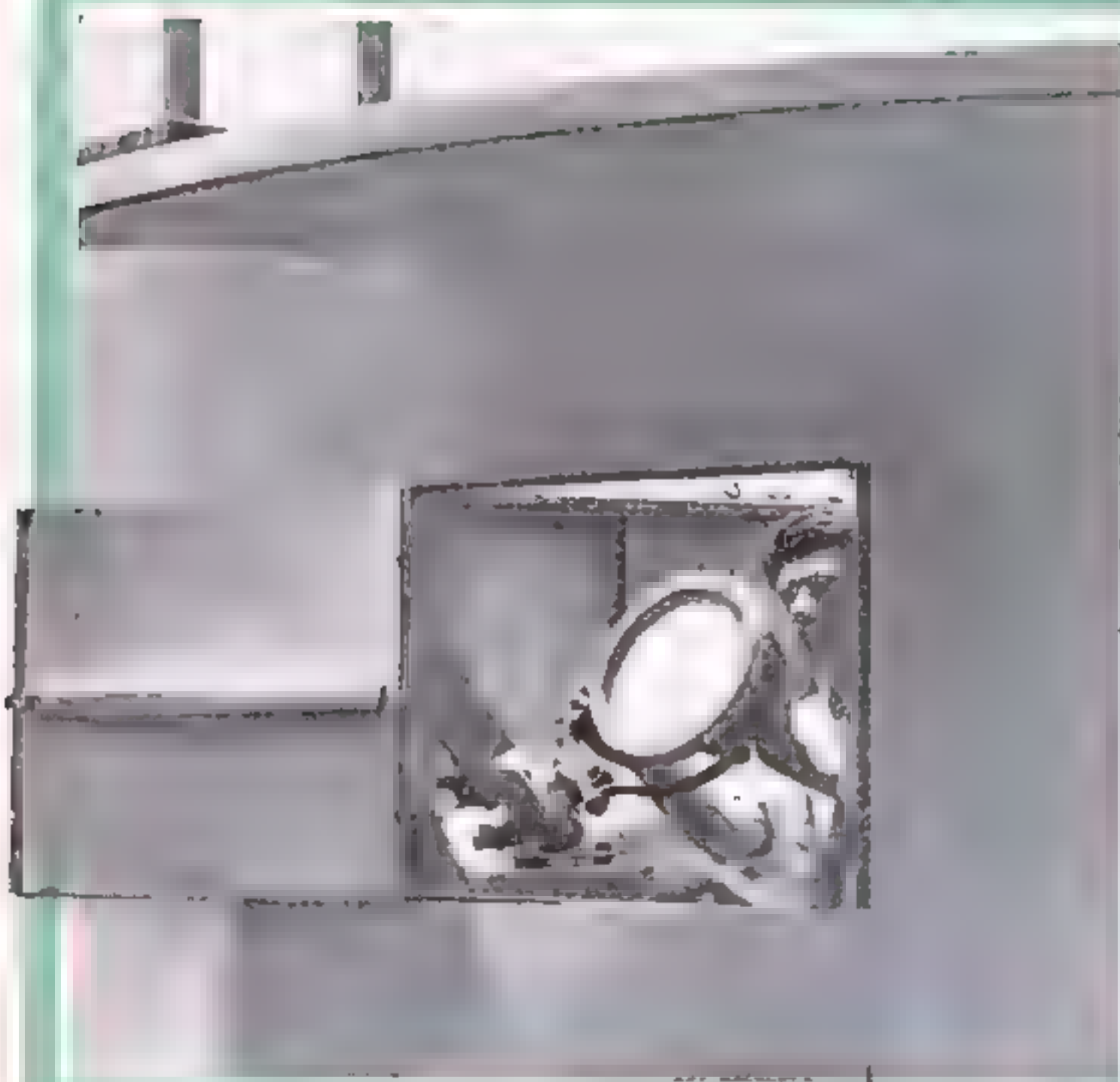
Here Murray is using map and protractor to plot the location of a quake from his seismograph records. The homemade microscope is used in reading the graphs



Model solar system showing the relative sizes of the sun, the earth, and the other planets



Murray 'shooting the sun' with a sextant that he made himself



Adjusting the mirror of the sun telescope, which projects an image upon a screen twenty feet away. Murray uses this apparatus to trace sun spots for his weather studies



A strong-motion seismograph for measuring heavy local up-and-down shocks as distinguished from horizontal ones

POPULAR SCIENCE

Question Bee

Have you tried our brain-teasing Question Bee game? Here's a new batch of scrambled information and misinformation for you to test your wits upon. Each of

these twenty-five questions has only one correct answer given with it. See whether you can pick out the right ones. Then turn to page 127 and see what score you made



there is no air, such as (a) monoplanes (b) rockets (c) dirigibles.

18 A laboratory instrument that separates light and heavy ingredients of a mixture by whirling it rapidly is called a (a) centrifuge (b) vermifuge (c) febrifuge (d) subterfuge.

19 The word "vortex" means (a) one of the corners of a triangle (b) a whirling mass of water or air like a whirlpool or tornado (c) the outer layer of gray matter of the human brain.

20 Binnacles should be (a) scraped off the bottom of ships in drydock (b) used to steer by at sea (c) lowered overboard on lines to take soundings.

21 A boa constrictor kills its prey by (a) injecting poison from its highly venomous fangs (b) coiling itself about an animal and squeezing it to death (c) dropping it from a tree.

22 "Sixty-two degrees, thirty-seven minutes, and four seconds" might be the measurement of (a) a temperature (b) a length of time (c) an angle.

23 You can turn salt water into fresh water by (a) placing it in bottles and waiting until the salt settles out (b) adding baking soda (c) shaking it (d) distilling it.

24 William Harvey discovered that (a) heating milk destroys the germs it contains (b) blood circulates through veins and arteries (c) bad eyesight is helped by glasses.

25 You will be giving a correct answer to the question, "In a vacuum, will a feather fall slower or faster than a cannon ball?" if you reply, (a) "Faster" (b) "Slower" (c) "No."

1 Lions belong to the family of (a) cats (b) dogs (c) zooids (d) bears.

2 The air we breathe is a mixture of various gases, of which the one that we could not survive without is (a) nitrogen (b) oxygen (c) helium.

3 You would expect to find calipers in (a) a well-made piece of furniture (b) a zoo (c) contaminated drinking water (d) a professional musician's vest pocket (e) a machinist's tool kit.

4 The depth to which a submarine can dive is limited by (a) the amount of water pressure its hull is strong enough to withstand (b) how much fuel it can carry (c) the size of its ballast tanks.

5 If you had one eye instead of two, you would find it more difficult to (a) match colors (b) recognize shapes like circles and squares (c) judge distance (d) look through a microscope.

6 Gold is not being extracted from sea water at present because (a) this has been forbidden by a U. S. Treasury ruling (b) the amount of gold recovered would not pay for the cost of extraction (c) there is no gold in sea water.

7 Sunshine contains invisible rays, which cause sunburn and play an important part in our health, called (a) cosmic rays (b) ultra-violet rays (c) X rays (d) cathode rays.

8 If someone asked you how big the moon looked, the most sensible thing to say would be, (a) "As big as a button" (b) "As big as a grapefruit" (c) "As big as a small pea at arm's length."

9 Ordinary flat maps of the world give a misleading impression because they exaggerate the size of areas near (a) the equator (b) the north and south poles (c) the International Date Line.

10 The thing on a camera that you press to take a snapshot operates the (a) focusing scale (b) view finder (c) shutter (d) iris diaphragm.

11 Medications that kill germs are called (a) anesthetics (b) anti-septics (c) narcotics (d) histrionics.

12 The kind of electricity that reverses its direction many times a second is called (a) direct current (b) alternating current (c) static electricity.

13 Ocean tides are produced by (a) the gravitational pull of the sun and moon (b) the trade winds (c) expansion and contraction of sea water with changes in temperature (d) the eruption of submarine volcanoes.

14 The father of radio was (a) Galileo (b) Edison (c) Marconi (d) Darwin.

15 Expensive fur coats are made from the pelts of the chinchilla, which is (a) a ferocious bear found in the wilds of Tibet (b) a squirrel-size rodent of South America (c) one of the fleetest of Australian kangaroos.

16 When it is winter in the United States, in South America it is (a) spring (b) summer (c) fall (d) winter.

17 If we are ever able to navigate to distant planets, it will be in craft capable of propelling themselves where

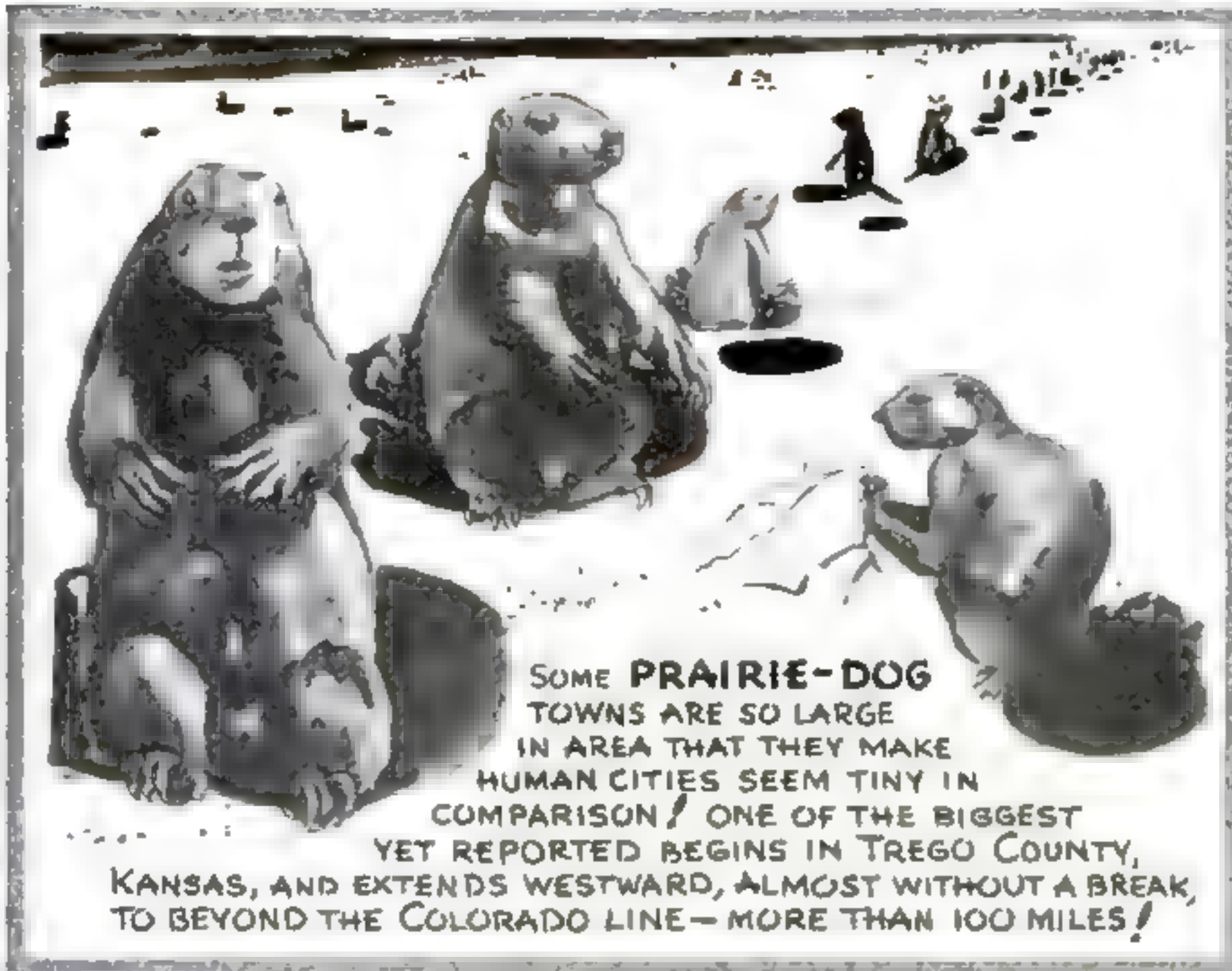


Do you know the names of these common woodworking tools, listed below? Try to label the pictures correctly

auger bit	back saw	bit brace
chisel	countersink	gimlet bit
hand saw	nail hammer	gouge
plane	try square	twist drill

Un-Natural History

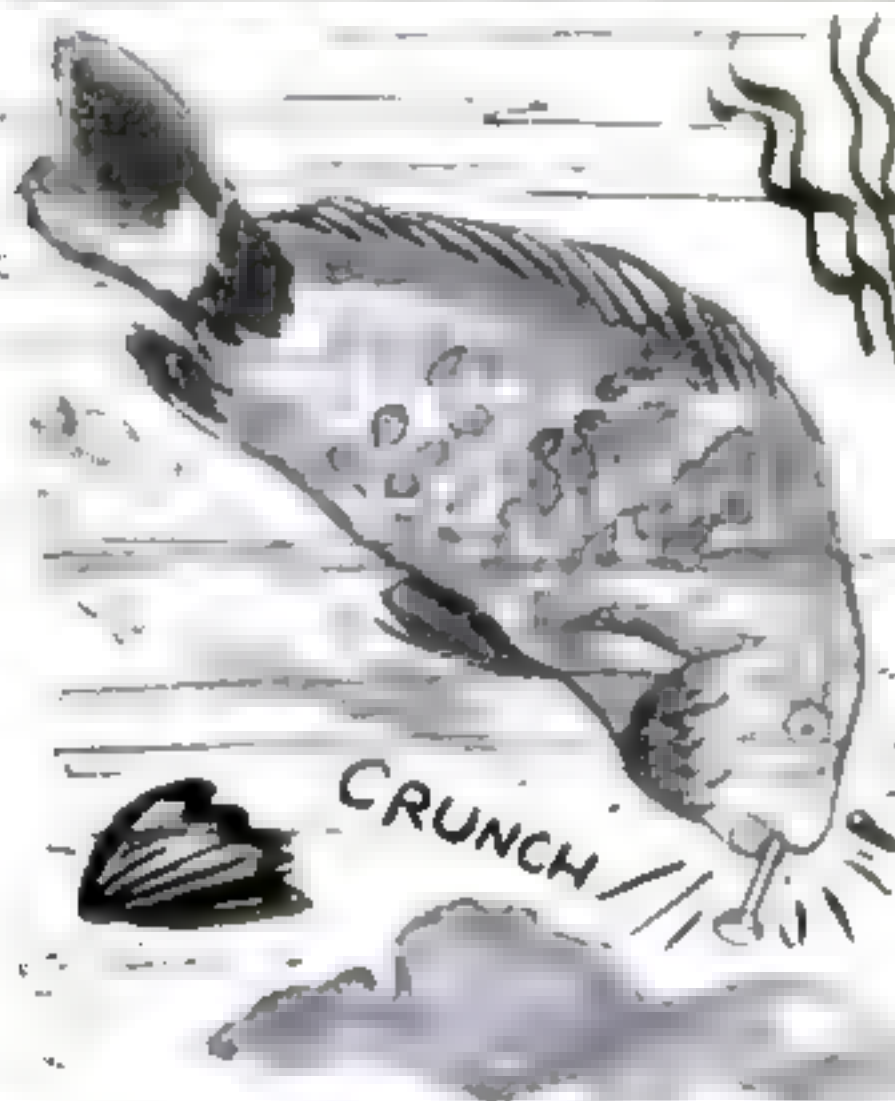
By
GUS MAGER



SOME **PRAIRIE-DOG** TOWNS ARE SO LARGE IN AREA THAT THEY MAKE HUMAN CITIES SEEM TINY IN COMPARISON! ONE OF THE BIGGEST YET REPORTED BEGINS IN TREGO COUNTY, KANSAS, AND EXTENDS WESTWARD, ALMOST WITHOUT A BREAK, TO BEYOND THE COLORADO LINE—MORE THAN 100 MILES!



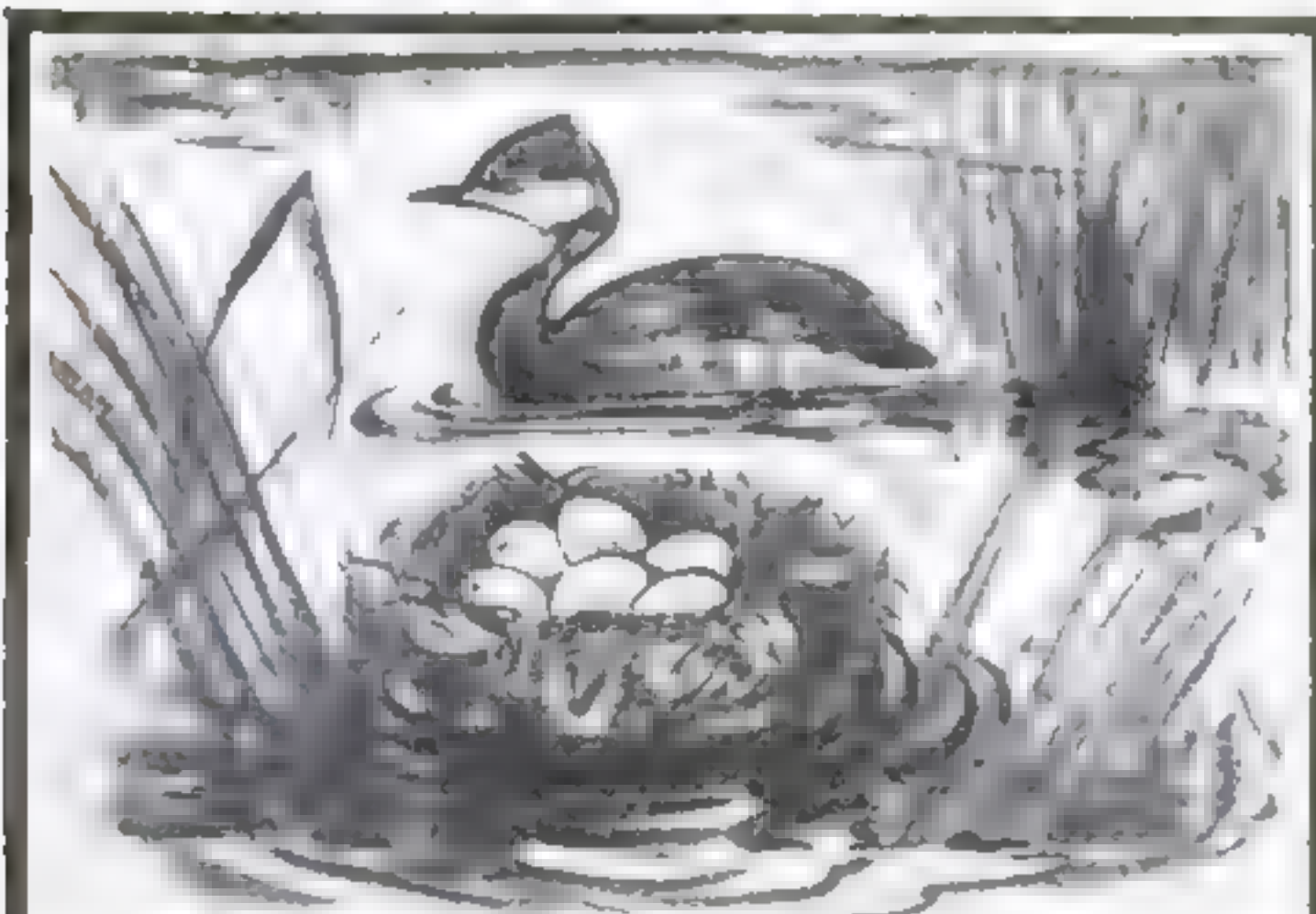
COTTON GROWS ON TREES! IN BRAZIL, PERU, AND OTHER WARM COUNTRIES WHERE THERE IS NO FROST TO KILL THE PLANTS, THEY KEEP GROWING YEAR AFTER YEAR, AND SOME SPECIES GET TO BE AS BIG AS FRUIT TREES!



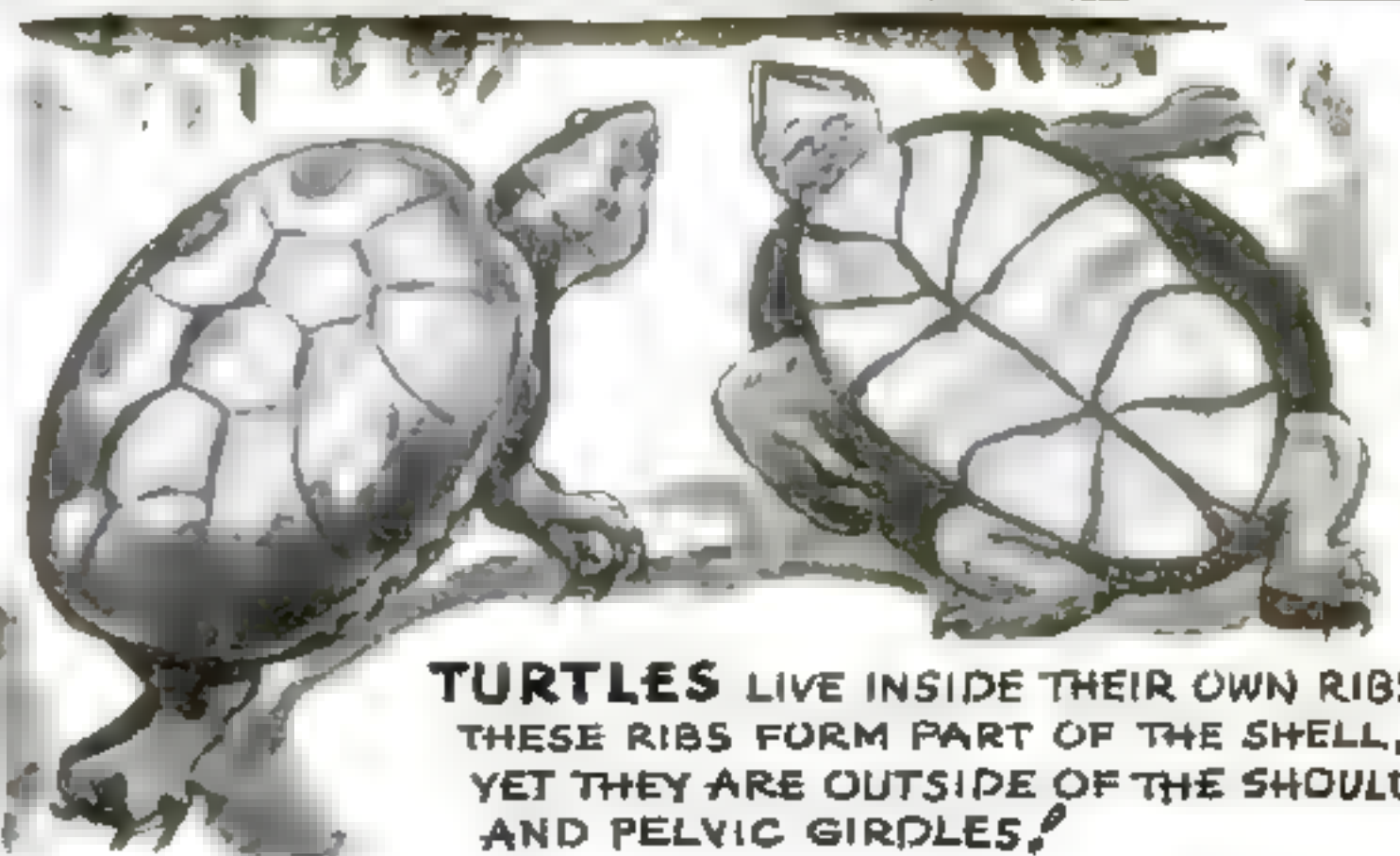
PARROT FISH, NATIVE TO THE SOUTH ATLANTIC AND ALSO FOUND IN THE SOUTH SEA, HAVE BEAKS SO ASTOUNDINGLY STRONG THAT THEY CAN BITE THROUGH WIRE NAILS OR FISHHOOKS, CRUSH CORAL, AND CRACK HARD CLAMSHELLS. YET THEIR PRINCIPAL FOOD IS SEAWEED!



MAN NEVER INVENTED A TOOL OF MORE ALL-AROUND USEFULNESS THAN THE **ELEPHANT'S TRUNK!** IT IS A SUBMARINE AIR HOSE—A DRINKING STRAW—A SHOWER BATH—A BLOWER—A SMELLER—A FEELER—A DERRICK! IT SERVES AS A NECK, ARM, AND HAND! EVEN THE LITTLE FINGER ON THE END CAN BE USED TO PULL A NAIL!



YOU'LL NEVER SEE A **GREBE** ON LAND! THIS STRANGE RELATIVE OF THE LOON SPENDS ALL ITS LIFE ON OR ABOVE THE WATER—IN FACT, ITS LEGS ARE SO FAR BACK ON ITS BODY THAT IT PROBABLY COULDN'T WALK. IT MAKES A FLOATING NEST OUT OF RUSHES AND DRIFTING VEGETATION!



TURTLES LIVE INSIDE THEIR OWN RIBS! THESE RIBS FORM PART OF THE SHELL, YET THEY ARE OUTSIDE OF THE SHOULDER AND PELVIC GIRDLES!

Handy Aids for



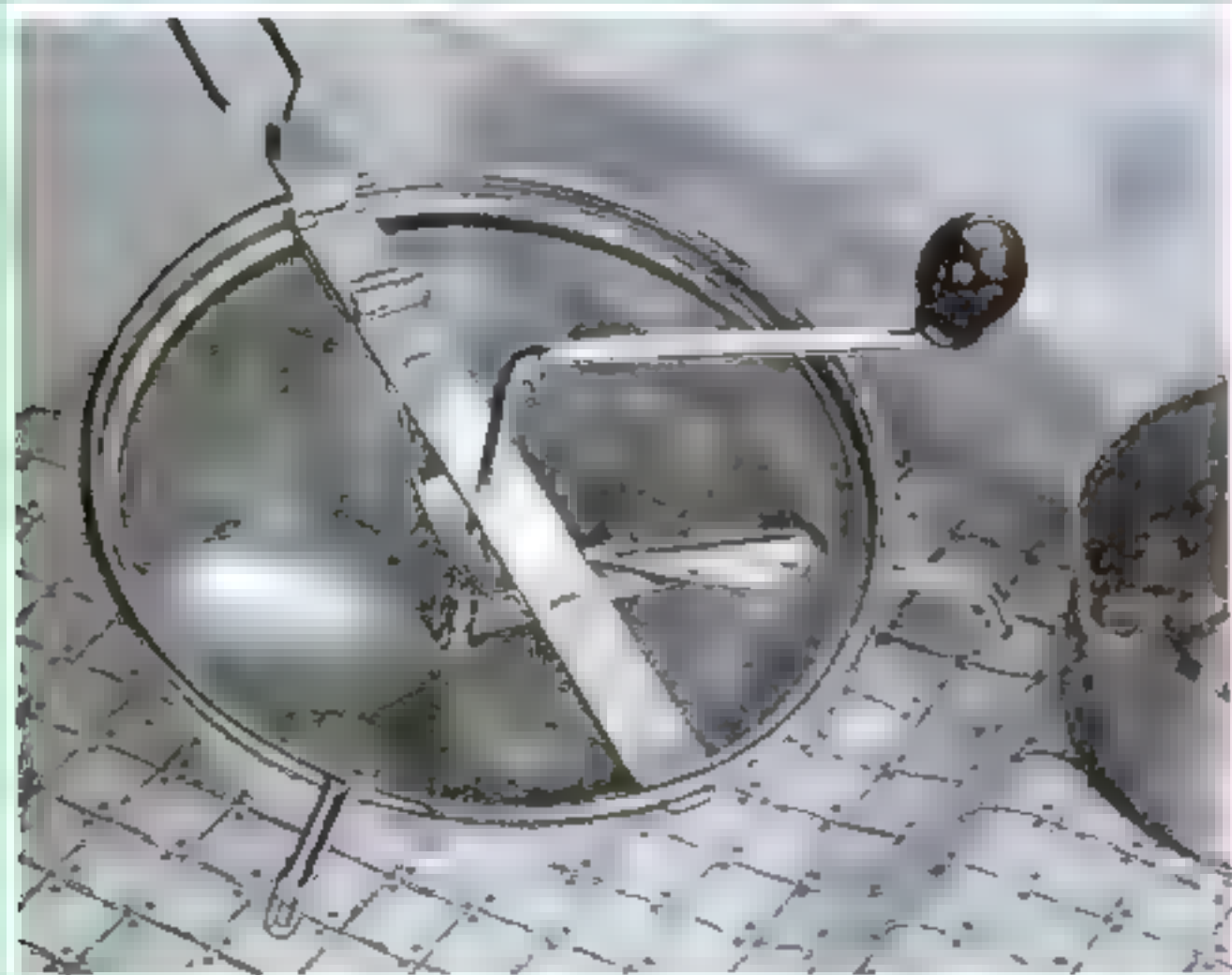
DOUBLE WAFFLE IRON. Two full-size waffles are baked at once in this reversible iron, which takes up no more space than one of ordinary design



HANDY BASKET FOR LAUNDRY. A new canvas bag hangs on the washer to catch the clothes, and can be carried easily or hung on the line

EGG OPENER. Squeezed together and pressed down over the top of a soft-boiled egg, the blades of the odd accessory at left shear off the upper shell

ROLLER STRAINER. In the strainer shown below, an egg-shaped roller presses the food against the mesh, and a rotating scraper prevents clogging



ICE FROZEN IN CUPS. Each piece of ice is sealed in an individual cup, in the novel freezing tray at left and below. A twist of the cover removes the cylinder of ice from the container



the Household

SUGAR DISPENSER

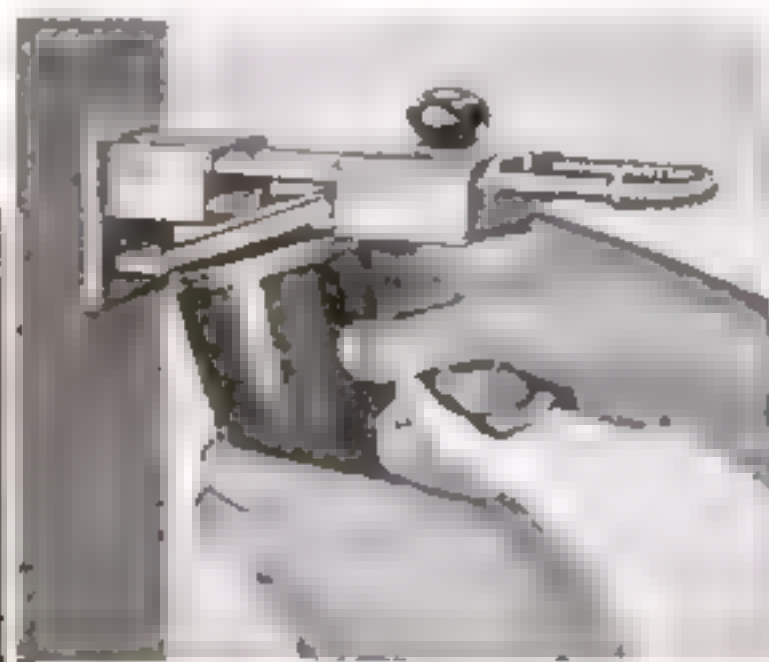
When tilted, the bowl at the right pours out the equivalent of a teaspoonful of sugar. To sprinkle the sugar, the bowl can be shaken.



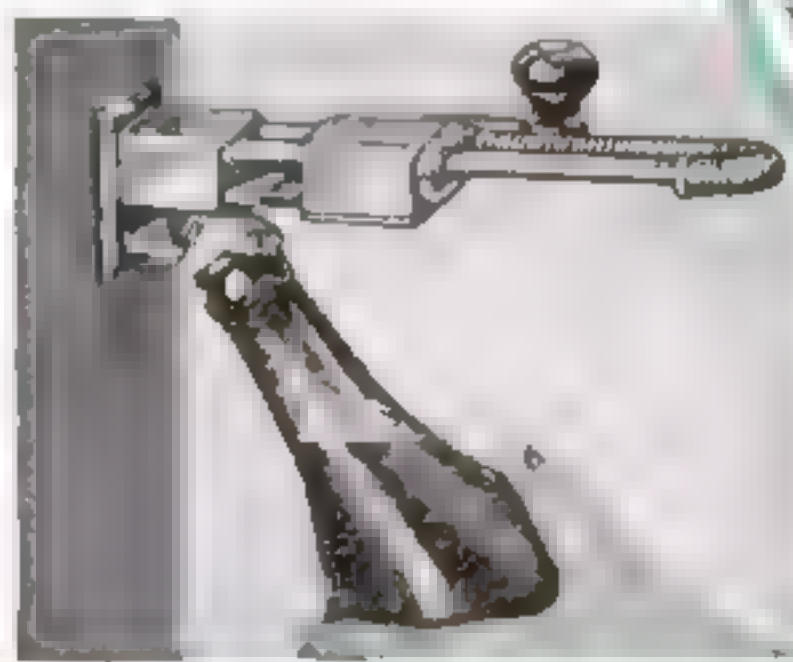
NUTCRACKER. The pincerlike feature of the novel nutcracker below comes in handy for breaking shells of Brazil nuts and other troublesome varieties.



JAR OPENER AND SEALER. Screw-top food containers are opened and resealed easily with the new kitchen fixture shown below. A quick-acting cushioned vise grips the cap, while the jar is turned. It also lifts ordinary bottle caps.



AUTOMATIC WASHER. When clothes are put into the washer seen at left, above, and two dials are set, the machine will automatically wash them, rinse three times, and wring damp dry.



DOUGHNUT MOLD. In the mold shown above, three doughnuts can be cooked simultaneously over an open flame. Since no grease is used, the food is easy to digest.



FRUIT JUICER

A detachable scraper that forms a part of a new fruit-juice extractor makes it possible to squeeze oil from the rinds of the fruit whenever the added tang is wanted.



Is There a REAL Gus Wilson?

By MARTIN BUNN

ARE Gus and Joe real people—or did you just make them up?" That is the gist of scores of letters I have received from readers of POPULAR SCIENCE MONTHLY, since I began passing along the nuggets of car wisdom that I get from these two veterans of the garage business.

Let there be no doubt about it—they're both very much alive! It's true that Gus Wilson, Joe Clark, and their Model Garage are all fictitious names. I had to promise the real, flesh-and-blood "Gus" and "Joe" to keep their identity a secret before they would let me tell you of their experiences. But it won't be betraying any confidence to say that the "Model Garage" which they jointly own is situated in a town not far from New York City. "Gus," the veteran automobile mechanic who knows more about the innards of a car than any two other men I could name, bosses the mechanical work, while his partner, "Joe," handles the bookkeeping side of the business. If you ever chance to stop at their garage, quite likely you will recognize them—for the artist who draws these illustrations knows them personally, and his pictures of them are as true to life as I've tried to make these stories of their experiences.

Gus started in the garage game back in the days before automobiles had windshields, and when the progressive gear shift was the very latest thing out. Since then he's worked on pretty nearly every make of car that ever embellished or cluttered the road. Gasoline motors are his hobby, as well as his profession,

and his worst fault as a practical business man is his reluctance to let any helper take work off his hands. He won't do it, if he thinks he can do the job just a little better himself—and he usually can!

Gus's manners may seem gruff before you get to know him, but he really has only one pet grouch. When he sees a man abusing his car, clashing the gears or slamming on the brakes so hard that the car screeches to a stop, it affects him the same way that it would you to see a stupid or cruel driver beating a horse. On the other hand, he's never too busy to drop his tools, sit down beside a man who takes an intelligent interest in his car, get out a greasy pencil and a soiled envelope to draw diagrams on, and tell his customer plenty that isn't to be found in books. As for Joe, he divides his time between poring over his ledgers and admiring his partner's skill.

\$100

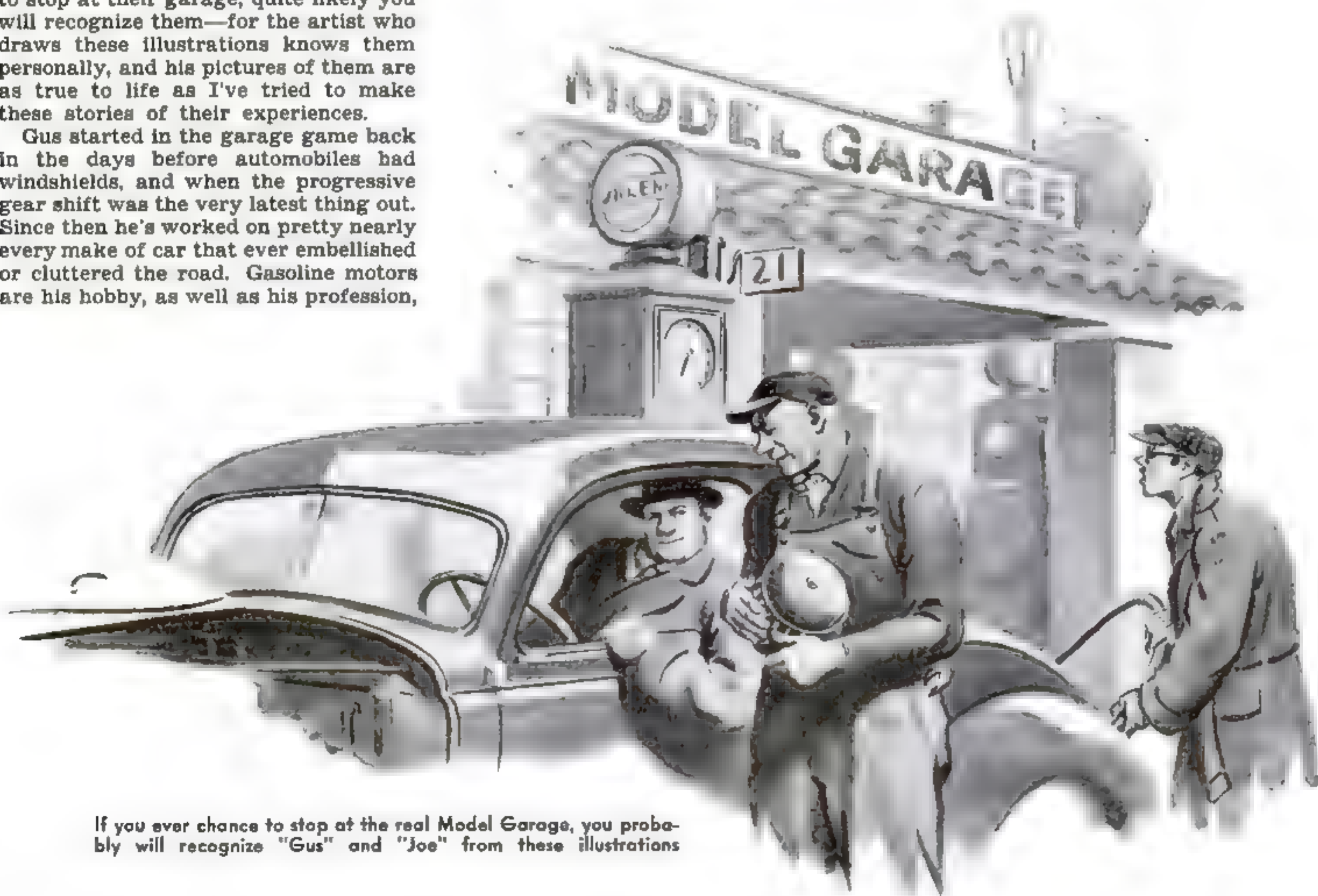
IN CASH PRIZES

FOR quite a number of years, "Gus" has been telling you all about cars. Now he and the Editor of Popular Science Monthly would like to hear about yours.

Has your car ever developed some strange, mysterious ailment—something outside the usual run of a motorist's experience? For the most interesting letter of not more than 500 words, telling of the queerest case of motoring trouble you have experienced and how it was cured, we will pay a cash prize of \$50. The second-best letter will win a prize of \$25, and the writers of the five next-best letters will get \$5 each.

You don't have to be a subscriber to Popular Science Monthly, nor purchase any copy from the newsstands, to enter this contest. Only the employees of Popular Science Monthly and their families will be excluded from participating in the contest. The judges will be "Gus Wilson" and the technical editors of Popular Science Monthly, and their decision will be final. If they decide there is a tie for any prize, the full amount of the prize will be paid to each tying contestant.

Address your letters to "Gus Wilson," care of Popular Science Monthly, 353 Fourth Avenue, New York City, and be sure to mail them before midnight on January 15, 1938, the date when the contest closes. No entries will be returned.—Martin Bunn.



If you ever chance to stop at the real Model Garage, you probably will recognize "Gus" and "Joe" from these illustrations

THE HOME WORKSHOP



Making novelties from small bulbs, crêpe paper, and pipe cleaners



"White Widow" made from night-light bulb and socket decorated with twisted crêpe paper and red paper-punch cuttings. At right, a wire framework holds the dress

By
KENNETH
MURRAY



Laughable Lamps

HOME decoration isn't a subject to make light of, but here's a way to do it nevertheless. These comical lamps are formed from 7½- and 10-watt bulbs of the round, outside-colored variety, usually sold for 10 cents. More powerful lamps would be unsatisfactory because the novelties are not for general illumination—merely to add a spot of live color here and there.

The support over which the body is built up may be a wire framework or a small cardboard box of suitable proportions. Wadded pieces of tissue paper make good padding to shape out the figure, and the most easily applied covering is crêpe paper cut into strips across the grain. It will conform to the shape of the figure, over which it is tightly *(Continued on page 116)*



A dark-colored 10-watt lamp is used for the head of the bell boy, and the body is a cardboard box. Crêpe-paper rope covers the hat and serves as eyes and mouth





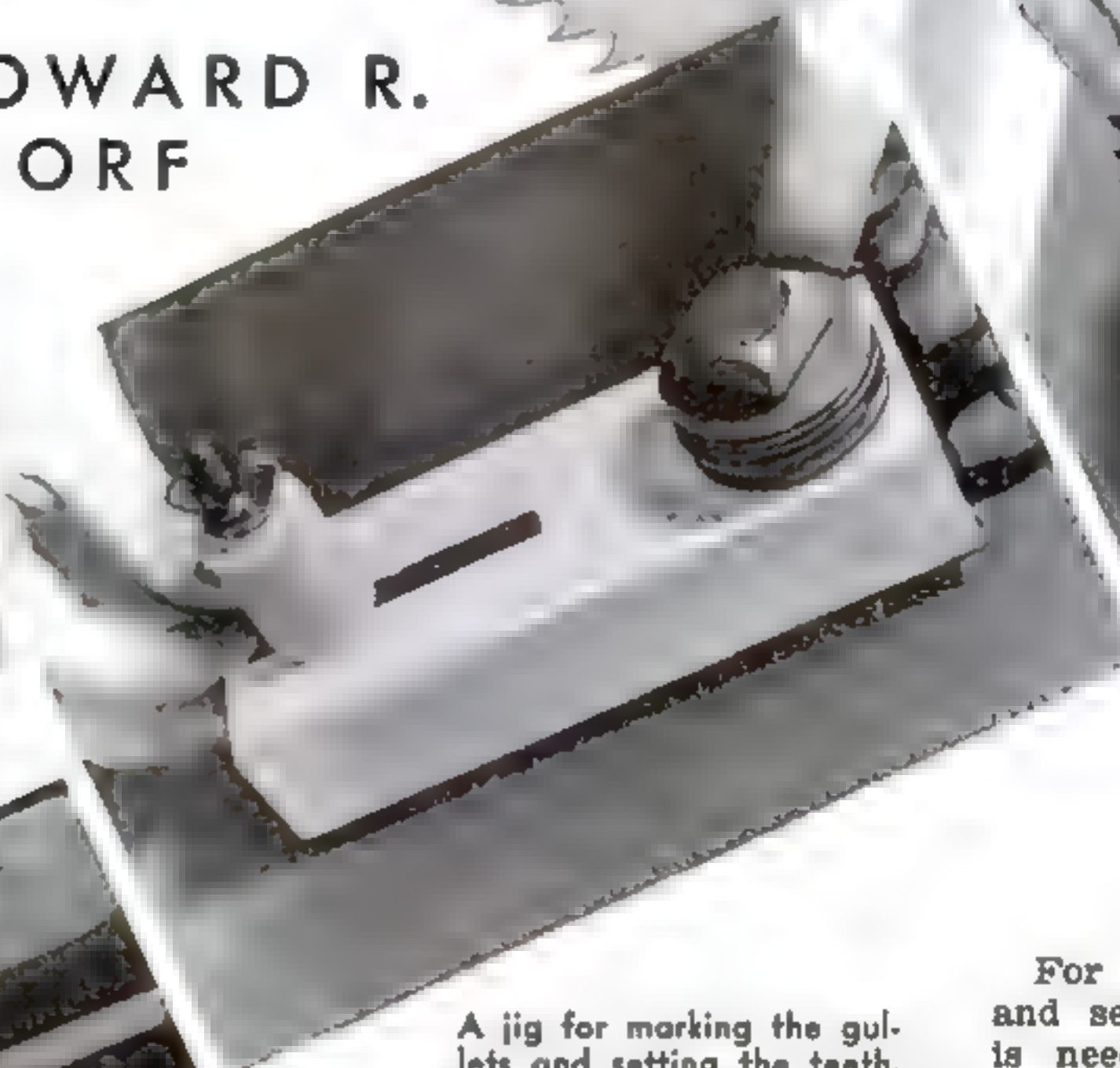
Saw-filing vise. The blade is held between two disks of wood, and lines are drawn to guide the file.

Never Let Your CIRCULAR SAWS Get Dull

By HOWARD R.
HEYDORF



Jointing the teeth with an oilstone. The saw is reversed and turned by hand.



A jig for marking the gullets and setting the teeth. Note how bolthead is filed.



The gullet outline is marked from a wooden template, spaced by using a locating pin.

of the steps in sharpening them must be slightly varied, but the main ones are jointing, gumming, setting, and filing.

Before anything is done to the blade, a drawing should be made of one of the teeth, preferably from

a new blade. This sketch should show the angles of the back and front of the tooth, the amount of set, the depth of the gullet, and the bevel of the tooth. When the blade is composed of more than one style tooth, the drawing should include the various kinds.

The first step is to joint the teeth. The saw is reversed on the arbor and a grooved piece of wood is placed over the blade as shown. An oilstone is held in place on this wood, and the saw is raised until it strikes the stone. When the saw is turned by hand, the stone levels the teeth. The saw should be jointed no more than is necessary to make the teeth level.

For marking the gullets and setting the teeth, a jig is needed. This consists of a piece of wood slotted at one end and with a $\frac{3}{4}$ -in. machine bolt and a number

of washers inset into the other end. In the slot slides a $\frac{1}{4}$ -in. carriage bolt on which a spacer piece is slipped, the top of the spacer being turned to fit the arbor hole of the saw. The shoulder of this piece should be the same height as the top of the machine bolt.

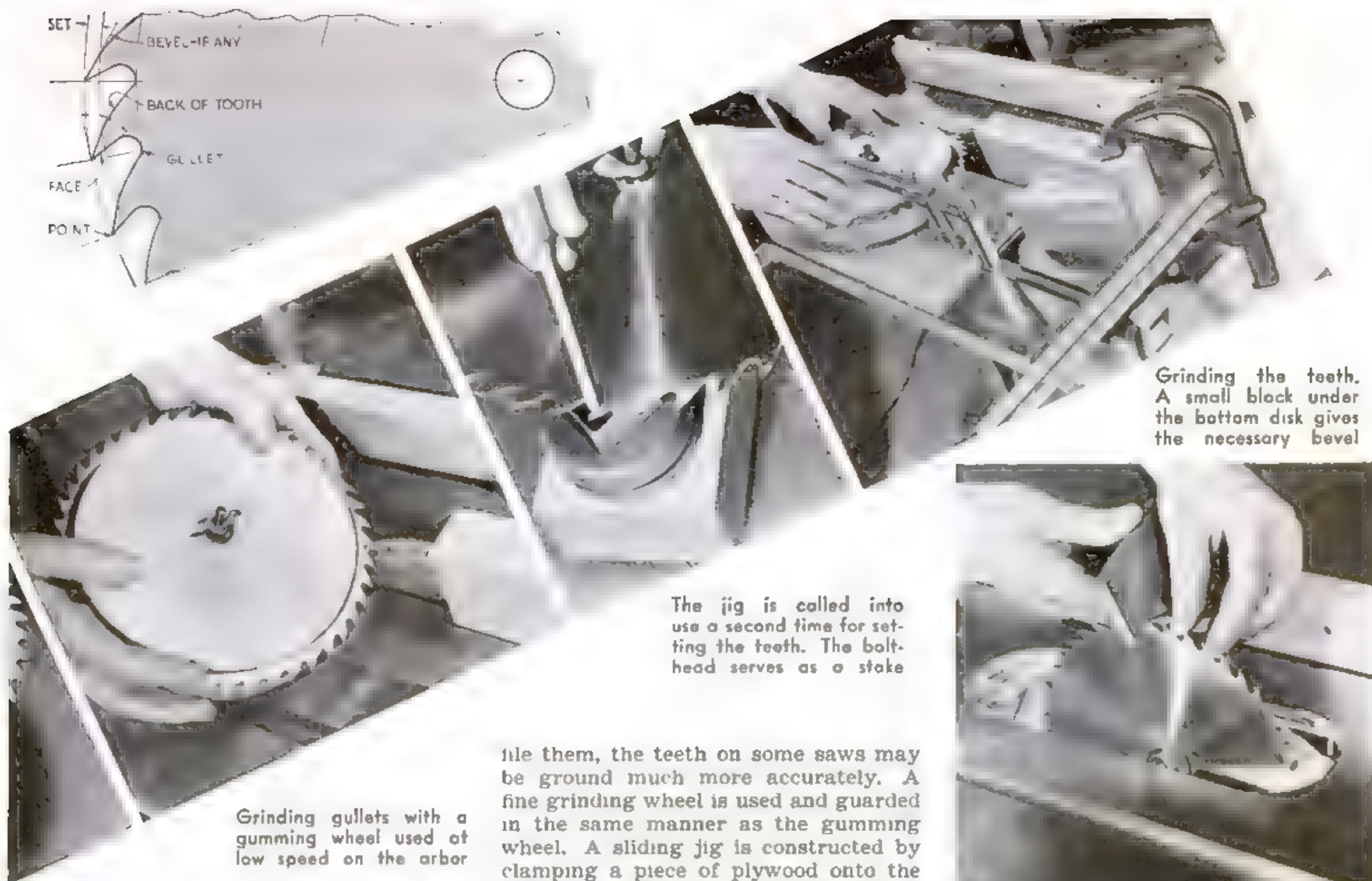
For marking the gullets, the jig is used as shown. A thin strip of wood, in which the outline of the required gullet is sawed, serves to make this marking operation quick and accurate. A metal pin is used to locate the strip for each marking.

A gumming wheel is next used to grind the gullets to shape. In this case the wheel is 8 in. in diameter and $\frac{1}{4}$ in. thick. Such a wheel may be used on the saw arbor if the speed of the machine is reduced, but a heavy wooden guard should be added to protect the worker. A table insert designed for use with dado heads is put in place to provide clearance around the wheel.

The large bolthead in the wooden jig is now used as a stake for setting the

WHEN it is properly used, a good circular saw is capable of doing nearly all the straightaway sawing required in the home workshop. The efficiency with which the machine operates depends, however, largely upon the condition of the saw blade. The amateur mechanic usually realizes this, but he is likely to have the mistaken idea that sharpening the saw is a difficult operation, and for that reason he may be inclined to wait as long as possible before taking steps to remedy the increasing dullness of the blade. Any delay is poor policy.

As saw blades differ in design, some



Grinding the teeth. A small block under the bottom disk gives the necessary bevel

The jig is called into use a second time for setting the teeth. The bolt-head serves as a stake

Grinding gullets with a gumming wheel used at low speed on the arbor

teeth. A corner of the bolt-head is filed to the required angle. Every other tooth on most saws is set on one side with a pin punch, and then the saw is reversed and the other teeth are set to the other side. Some saws are hollow ground and require no set.

While the customary method of sharpening the teeth of a saw is to

file them, the teeth on some saws may be ground much more accurately. A fine grinding wheel is used and guarded in the same manner as the gumming wheel. A sliding jig is constructed by clamping a piece of plywood onto the miter gage. Two wooden disks are required to hold the saw. The bottom disk is fastened to the plywood in the correct position and may be blocked up on one side to give the correct bevel. The side of the wheel is used for this grinding operation, a light pressure being employed.

For teeth that must be filed, the saw vise shown near the beginning of the article will hold the blade securely. To

The sharpened teeth are finished by rubbing them with an oilstone to remove burrs

aid in getting the bevels uniform, cross lines are marked on the tops of the disks. For best results, the sharpened teeth are finished with an oilstone.

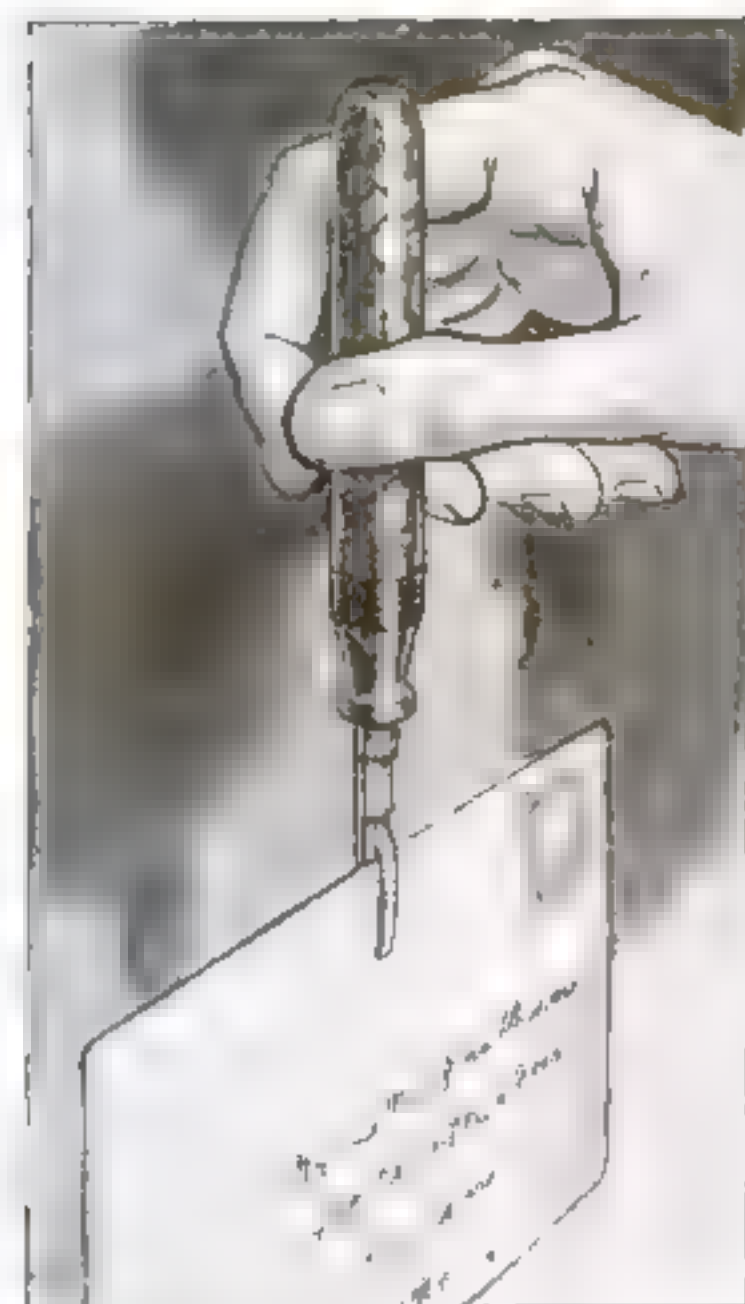
Old Fountain Pen Converted into Letter Scale

HOW often have you wondered whether a three-cent stamp was enough on a letter you were just about to mail? If you take a few minutes to make yourself a pocket scale from an old fountain pen like the one illustrated, you will be able to settle such questions instantly.

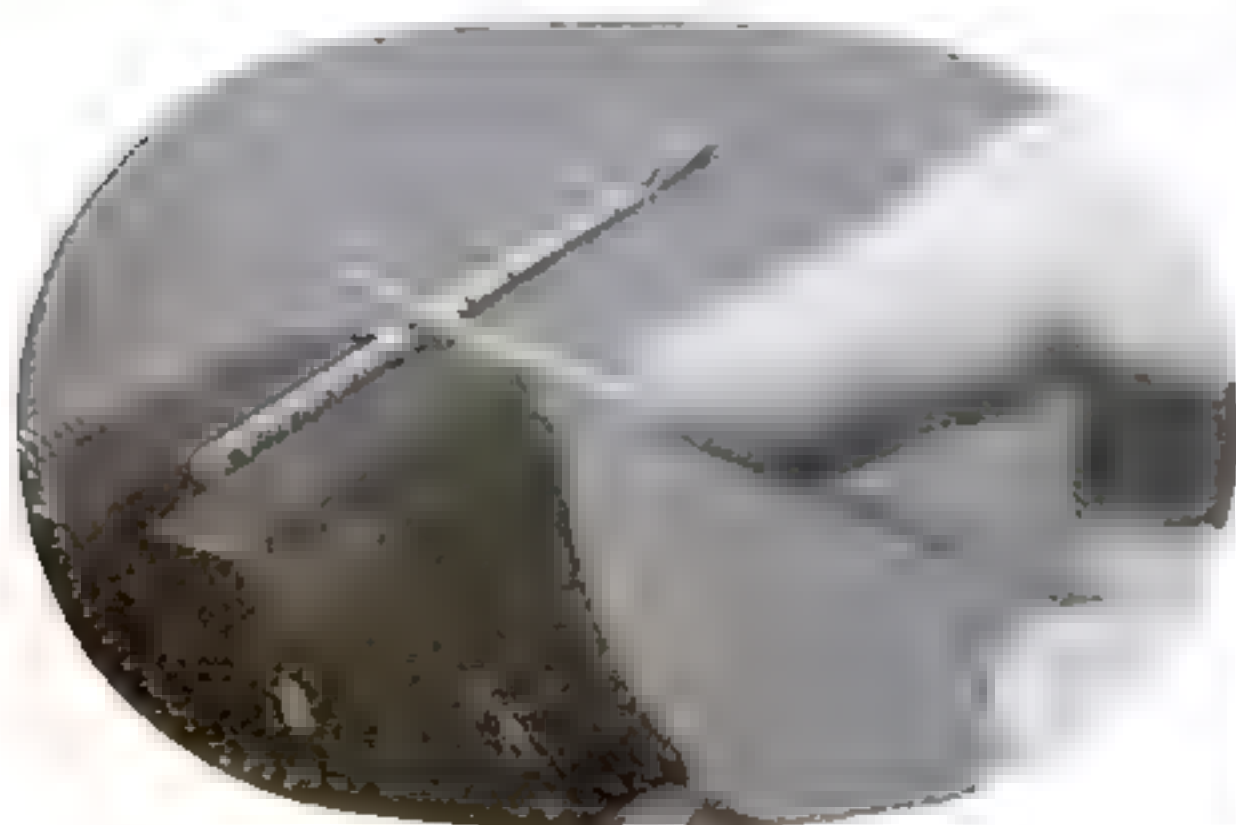
Remove the self-filler mechanism and rubber ink sack, as well as the nib and feeder. The remainder is used to house a brass rod of suitable length and diameter, and a coil spring of

lightweight brass wire. Make an oblique cut near the lower end of the rod to receive a short piece of watch spring. This functions as a clip to hold the letters to be weighed. A hook may also be provided for small packages.

Experiment will determine the right amount of tension in the spring. It should be flexible enough so that a 1-oz. weight will pull the rod down from $\frac{1}{2}$ to $\frac{3}{4}$ in. when the scale is held in the weighing position. With a file, mark the position for each additional ounce; then remove the rod and file deeper markings in it for permanent use.—K. L. ROBBINS.



Weighing a letter with the pocket scale. Left, parts before assembly. Extreme left, filing the notches



KNOTTED Ski Socks

TAKE THE GRIEF OUT OF UPHILL CLIMBING

By Arthur Holmes

EXPERTS and beginners agree that nothing takes the joy out of skiing so much as the uphill. "If skiing were only all downhill," they lament, "it would be all right."

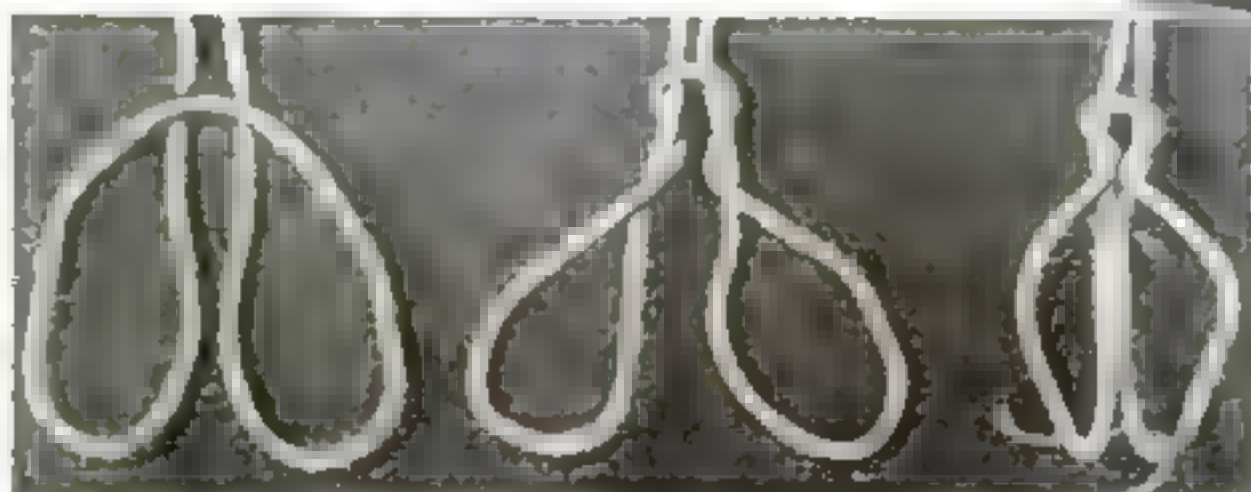
The park rangers in Yosemite National Park (California) have developed a rope "ski sock" for climbing steep snow slopes. It is the safest climbing aid in precipitous or dangerous country, very light in weight, inexpensive and simple to make, good in any type of snow, and easy to put on or take off the ski. Surprisingly steep slopes can be climbed straight up, thereby doing away with the necessity of traveling back and forth across the face of the hill. In fact, nothing has been found to equal the rope ski sock with the possible exception of sealskin climbers, which are quite expensive.

Obtain two lengths of $\frac{1}{4}$ -in. cotton braided sash cord, each about 18 ft. long. Double one of the ropes and fold back the doubled end upon itself, making two loops as shown. Each loop should be about 6 in. in diameter. Now twist each of the two loops two and a half times in the opposite direction from the other loop, and tie the loops together tightly with leather thongs, fishline, or other thin, strong twine. Note that the two inside ropes are tied together as close to the twists as possible, while the outside ropes of the loops are tied close to the untwisted end of the loops.

Once the loops are right, the rest is easy. A series of square knots are tied to lie alternately underneath and on top of the ski and extending back to the center of the ski.

Insert the ski into the loop, as illustrated, and tie the first knot on top of the ski; then tie the next square knot as tightly as possible beneath the ski, and so on until the center binding is reached. About five knots on top and five beneath will be adequate for a $7\frac{1}{2}$ -ft. ski for traveling in steep country. More or fewer knots may be used, but whatever the number, it is essential that the next-to-the-last knot be tied to lie directly behind the footplate of the binding.

An 18-ft. length of cotton braided sash cord is doubled and prepared as shown below, then knotted above and below the ski as at right



Ski socks enable one to climb without using the tiring herringbone step

and the last one underneath the ski directly below where the foot rests.

The several feet of unused rope are not cut off, but are used to fasten the rope sock to the ski, and none of the other knots is disturbed. When the socks are slipped on the ski in their original position, bring the extra rope up, wrap it around the ski in front of the ski binding, and tie the two ends together. The extra rope wrapped around the ski acts as a snubber.

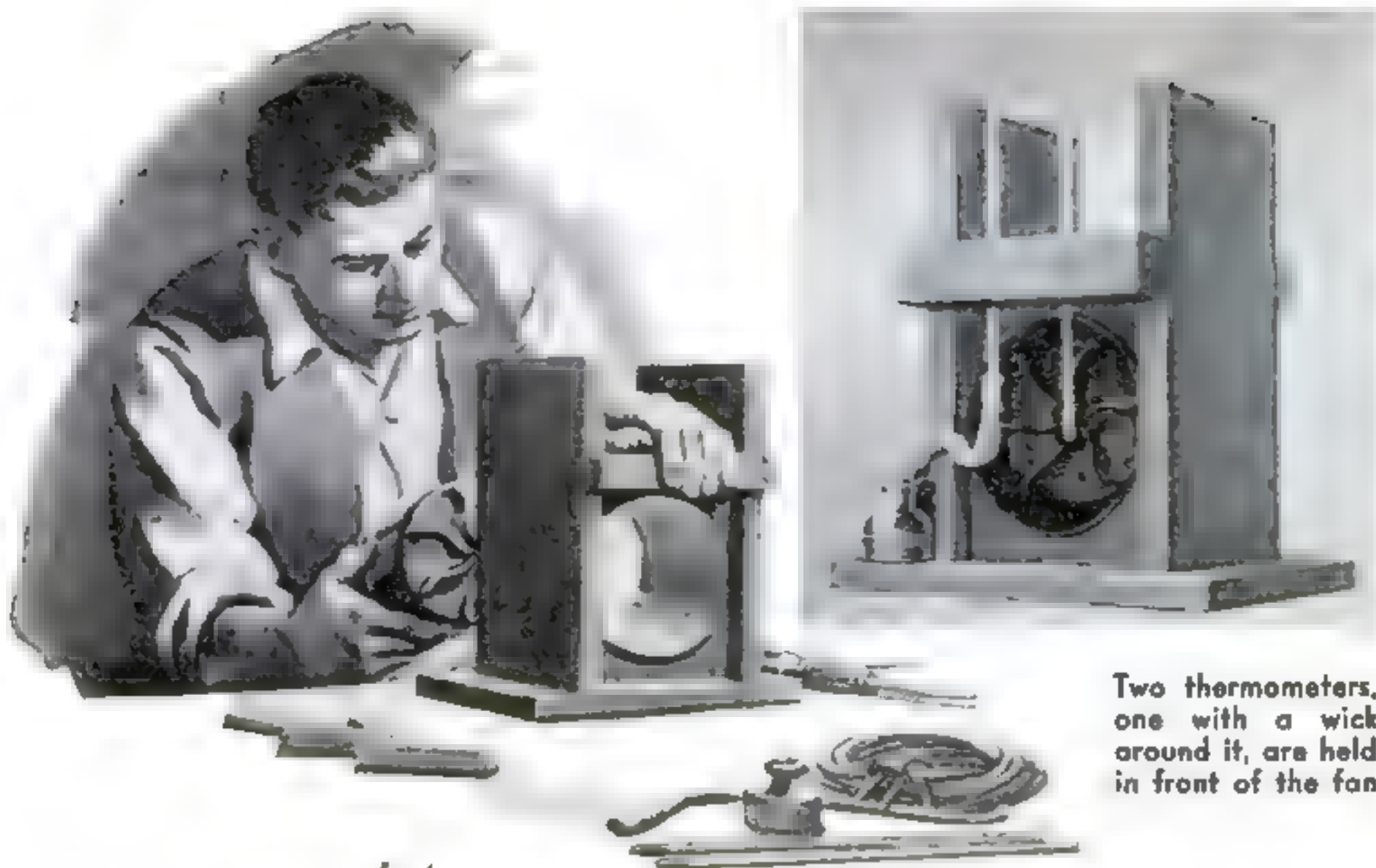
For traveling on the level or downhill, the front knot is untied and the ski sock is slipped off the ski. It can then be carried on the belt, slipped down on the handle of the ski poles, or placed in a knapsack.

Metal ski bindings or harnesses are, of course, necessary in using a ski sock. As a matter of fact, it is extremely difficult to ski with only a toe strap, and this form is seldom used nowadays by serious skiers. Furthermore, for climbing easy or short hills under, say, a hundred yards or so in

length, it would hardly be worth the trouble of tying on ski socks. It is on longer hills, steady climbs, or cross-country trips where hills predominate that these ski socks will be found to be worth their weight in gold.

The loop is slipped on the end of the ski, and the rope knotted





HOMEMADE DEVICE Measures Moisture in the Air

HYGROMETERS of the direct or easy reading type, particularly the low-priced ones, are likely to be inaccurate and unreliable, but any handy man can build a highly dependable instrument at small cost by using a couple of thermometers and an old vacuum-cleaner motor with fan. Since the amount of moisture in the air has a vital influence on our comfort, such an instrument is valuable, not alone to amateur meteorologists, but in every home.

Take the bottom and top out of a tin can of suitable size and wedge the vacuum-cleaner motor and fan into it as illustrated. Select a can large enough so that there will be room between the motor and the side of the can for a substantial air stream. Mount the can in a wooden frame that will also conveniently support two thermometers in a position where they can be read easily and

also where the fan will draw air over the thermometer bulbs, past the motor, and out through the opposite end of the can. Sew a lamp wick (or porous cloth) around one thermometer bulb, and place the free end of the wick in an old ink bottle filled with water and mounted on one side of the base.

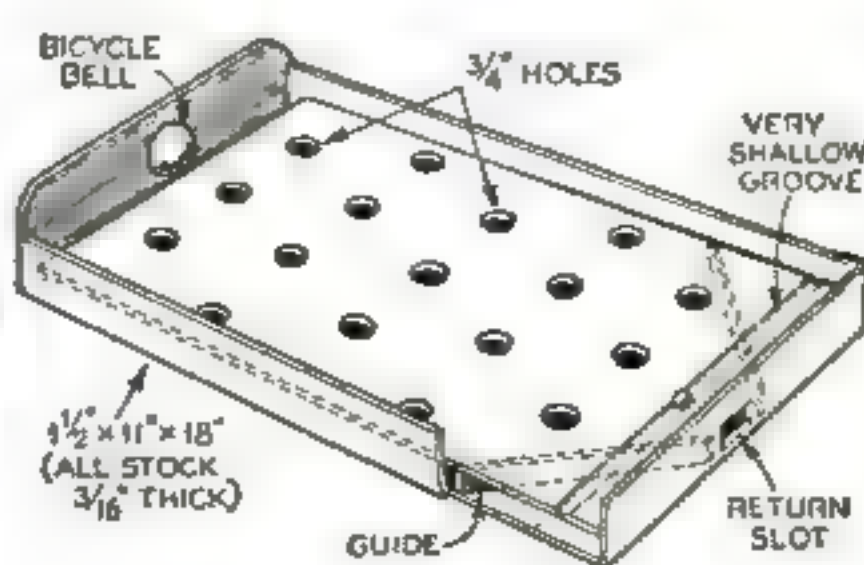
To find the humidity, turn on the motor and after a minute or so, take the temperature readings of the wet- and dry-bulb thermometers and refer to any available humidity tables, such as the "Psychrometric Tables" published by the U. S. Weather Bureau, for the exact relative humidity. You will then have the satisfaction of knowing that you are following the best method yet devised for measuring humidity in the air.—M. H. COMPTON.

Constructing a Test for Steady Hands

YOUR steadiness of hand and muscular coordination are put to a test in an entertaining way by this new marble game, "Tip." The object is to roll the marble across the board so that it

strikes the bell. To do this, the game must be held with both hands and tipped so the ball will roll over the board without falling into one of the holes.

At the start of each game, the marble is placed anywhere in the shallow groove at the front. Three turns are allowed in one play, and the game may be five or ten plays. The person ringing the bell the most times wins the game.



Refrigerator Alcove Modernizes Kitchen

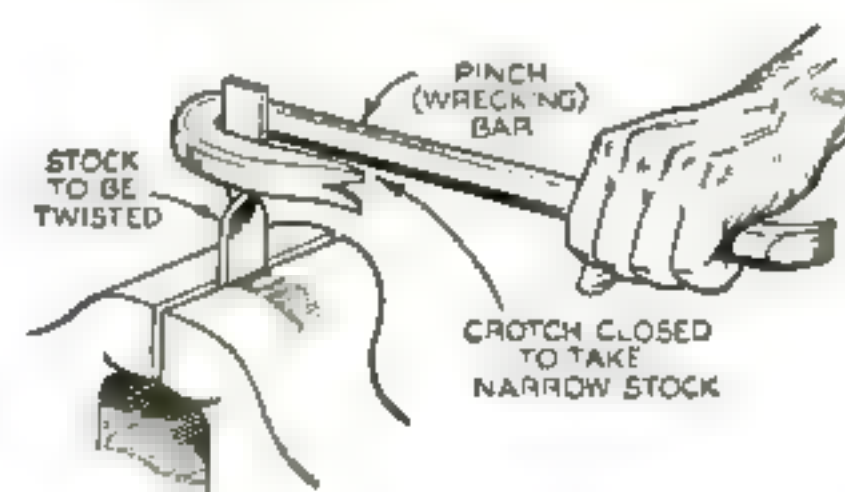
MANY of the substantial homes built a decade or longer ago had no special provision for the ice box, which was often placed, not in the kitchen, but on the rear porch. Since the modern mechanical refrigerator need not be accessible to the iceman and is not much affected by the heat of the kitchen, it is more convenient to keep it inside. This can sometimes be accomplished without sacrifice of room simply by building an alcove on the adjoining porch and cutting away the wall between. The improvement is well worth the trouble and trifling expense. A screened window in the back will provide ventilation—a desirable feature, especially where a gas refrigerator is used.—DICK HIXON.



How alcove for refrigerator is built on porch

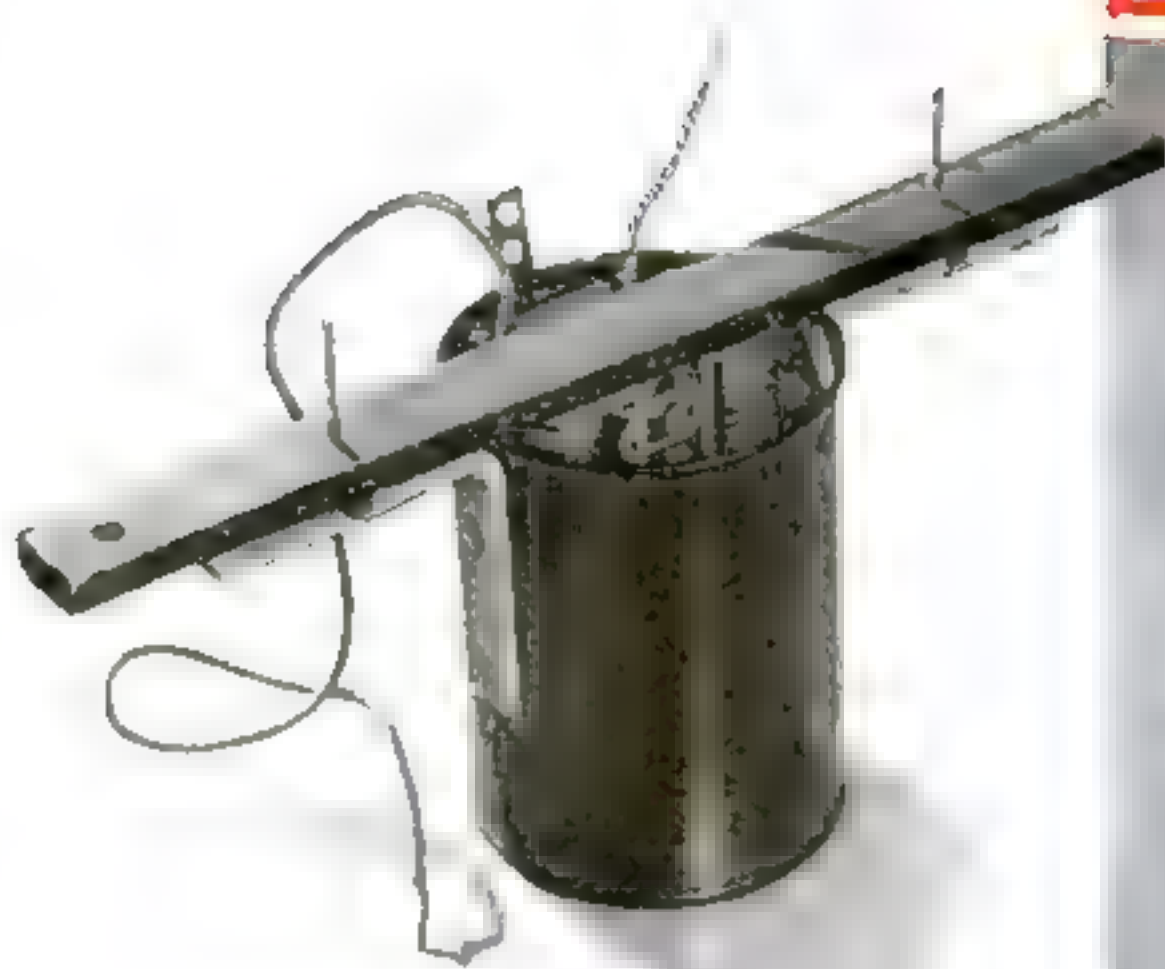
Silencer for Baby's Chair

A PIECE of rubber flooring or even ordinary linoleum cut to fit the inside of the baby's tray on the high chair and slipped into place will deaden the sound of blows from toys and spoons and protect the enamel.—W. W. WHEATLY.



Wrecking Bar Serves as Metalcraft Tool

IF THE U-shaped end of a wrecking bar of the type illustrated is heated and bent until almost closed, a useful tool is obtained for metal working. Bars may be twisted as shown, and if they are too heavy to be worked cold, they may be heated in the basement furnace or with a gasoline torch.—R. W.



The complete door chime and, at right, how it appears when mounted on the wall. The resonator bar is left unpainted

MUSICAL

Steel bar with tin-can resonator sounds a single loud but pleasant note when push button is pressed

By
WALTER
E.
BURTON



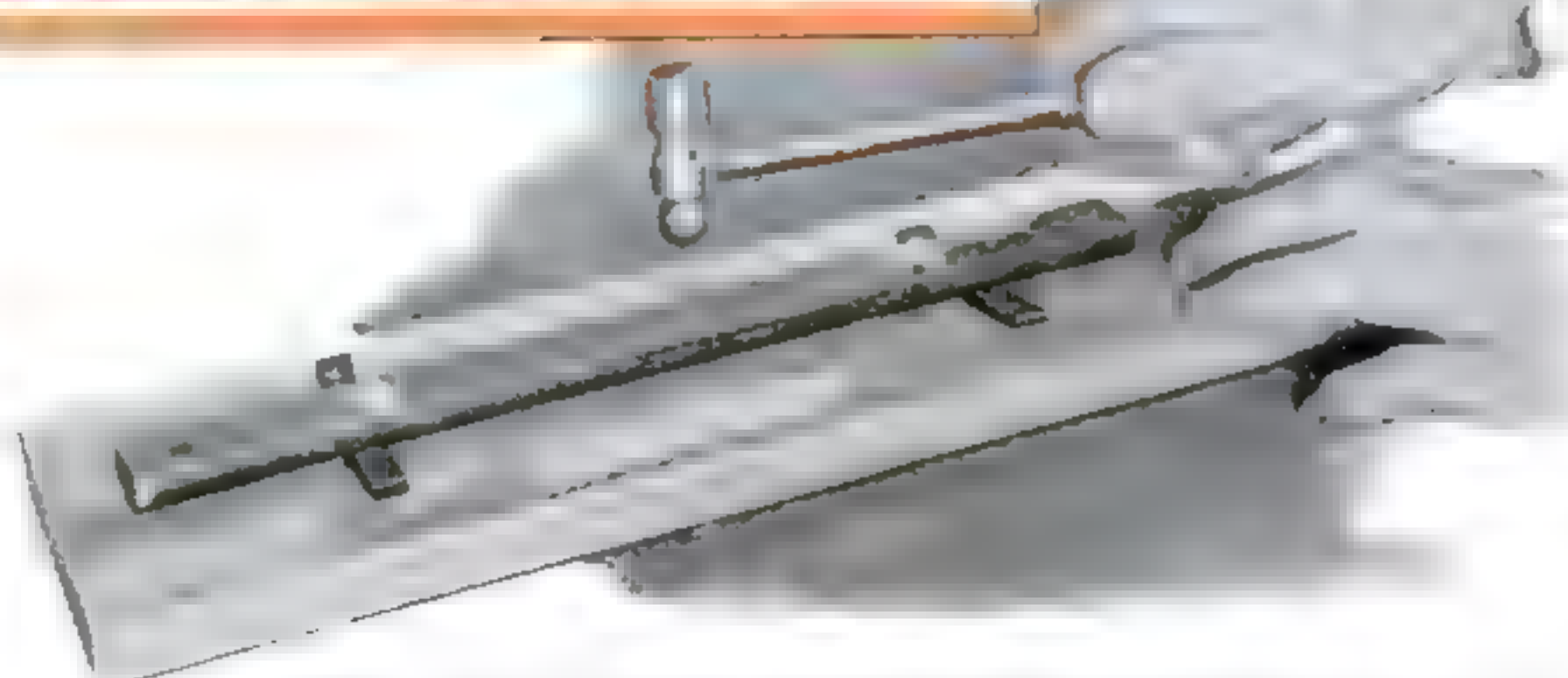
MORE pleasing to the ears than the old-fashioned doorbell is this musical chime, assembled largely from odds and ends. When the door button is pressed, the resonator-type chime emits a single pleasant note that can be heard throughout a large house.

The materials include a steel bar $\frac{3}{4}$ by $\frac{3}{4}$ by 11 $\frac{3}{16}$ in.; a tin can 3 $\frac{5}{16}$ in. in diameter, 4 $\frac{7}{16}$ in. deep; two right-angle iron brackets $\frac{3}{4}$ by 2 $\frac{1}{2}$ by 2 $\frac{1}{2}$ in.; a pair of electromagnets from an old doorbell or buzzer; a brass striker $\frac{5}{16}$ in. in diameter and 1 $\frac{1}{4}$ in. long, and miscellaneous bolts. The dimensions can be varied considerably without affecting the design.

The resonator is merely an empty tin can arranged so that the vibrating bar is across its open end, the center of the bar being in line with the center of the can. The air column in the can vibrates in sympathy with the bar, and reinforces the sound given off by it. It is necessary to match the frequency of the bar to the natural frequency of the air column in the can. This can be done either by varying the depth of the can or the length of the bar.

To test a bar for its musical-producing ability, lay it across two strips of soft rubber, such as pieces cut from a rubber sponge, and strike it in the center with a small hammer or rubber mallet. Hold the can with its open end directly above the center of the bar. If the can and bar are in resonance, there will be an immediate increase in the volume of sound. If they are not, try using cans of different depths, or bars of different characteristics.

When a bar is struck in the center, it vibrates in such a way that, some distance from each end, there are points where the metal remains practically stationary. To find these points, sprinkle a few grains of sand on the surface of the bar while it rests horizontally on the two rubber strips, and tap it lightly in the center. This will cause the sand grains to "walk" to the points of least vibration and arrange themselves



Grains of sand are used to find the stationary points or nodes of the vibrating steel bar. At these places the mounting holes are drilled

in narrow bands extending across the bar. At these points, punch-mark the bar for drilling the holes to be used in mounting it.

On opposite sides of the tin-can resonator, mount the right-angle brackets by means of short bolts extending through holes in the brackets, and through holes punched in the can with an ice pick. Center the bar with respect to the brackets and the can, and mark the positions of the mounting holes, after these holes have been drilled in the bar. Drill the brackets to receive 1-in. lengths of rod about $\frac{1}{16}$ in. in diameter, such as a piece of wire nail or bronze wire like that used for brazing. The rods should enter the bracket holes with a driving fit. Push short lengths of rubber tubing (which can be taken

from a piece of insulated wire) over the pins to insulate them from the vibrating bar. When the bar is in position, it is further insulated by resting on sponge-rubber crosspieces about $\frac{1}{8}$ by $\frac{1}{8}$ in. in cross section. The holes in the bar should, of course, be big enough to accommodate the rubber tubing when it is in place over the pins. The fit should be loose, not snug.

The striking mechanism consists of a pair of electromagnets from an inexpensive doorbell, and an armature to which a piece of springy wire, such as the bronze brazing rod already mentioned, bearing the hammer is attached. If the doorbell magnets already have an attached armature and interrupter mechanism, remove the interrupter and arrange the connections so that the

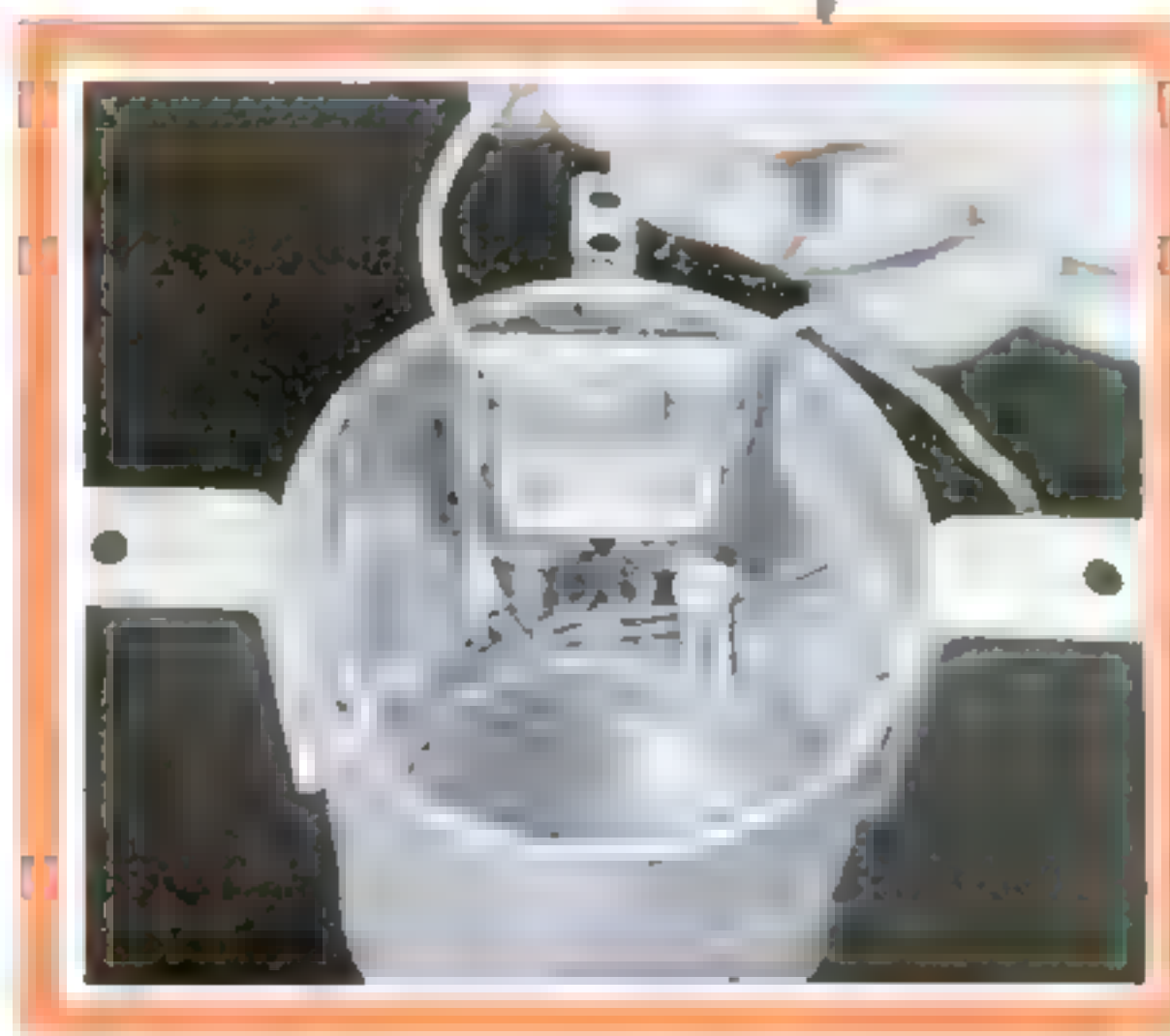
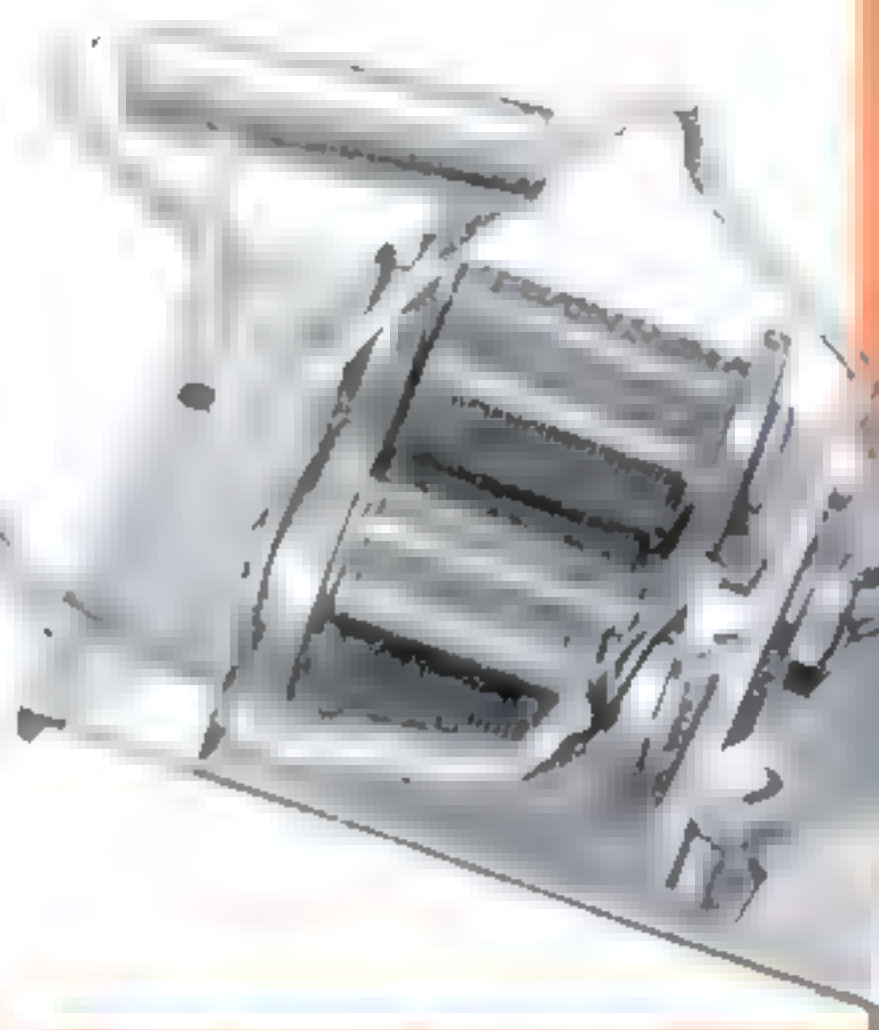
DOOR CHIME

coils are in series with the doorbell button and batteries.

When no current is flowing through the coils, the armature rests against a bolt that acts as a stop to hold it a short distance from the magnet cores. When the button is pressed, the armature snaps against the cores, and the hammer, on its springy support, strikes against the bar and then rebounds a fraction of an inch. It is held there, almost but not quite touching the bar, until the current stops flowing, when gravity returns it to the "open" position. The striker has a hole drilled laterally so that it can be driven on the end of the wire. Note the way the striker wire is bent back and forth to provide a springy action.

Mount the chime against the wall so that the vibrating bar rests horizontally on its rubber pads. A strip of brass or tin plate with two holes in it, soldered to the side of the tin-can resonator and projecting an inch or so above it, provides a means of fastening. Finish the resonator, angle brackets, and other exposed metal parts—all except the vibrating bar—with paint or lacquer. Do

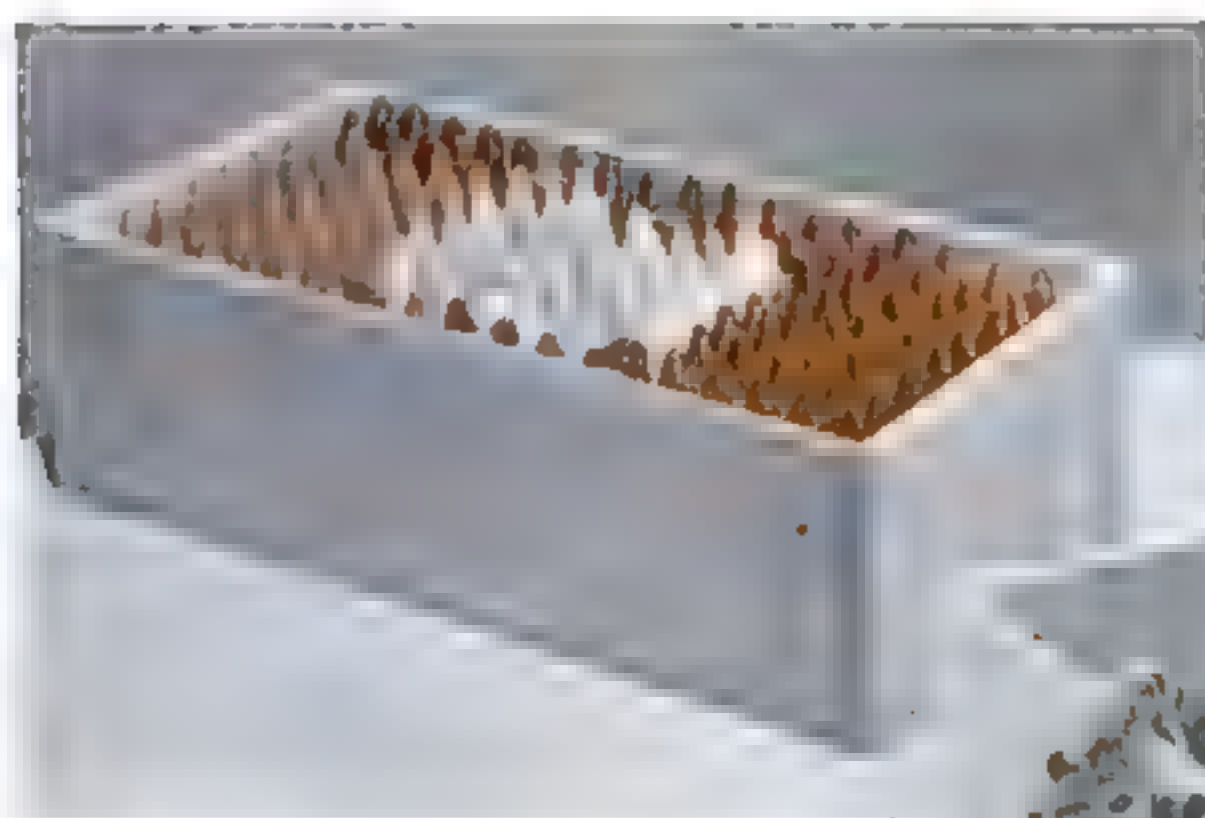
Right, the bar rests on rubber cushions and is held by two rubber-covered pins. Below, the striker mechanism and how it is placed in the can. The hammer strikes the bar at or near the center



not apply any finish to the bar other than a light coat of oil, or nickel or chromium plating. In mounting the resonator, do not have its bottom in contact with anything, or the volume will be diminished.

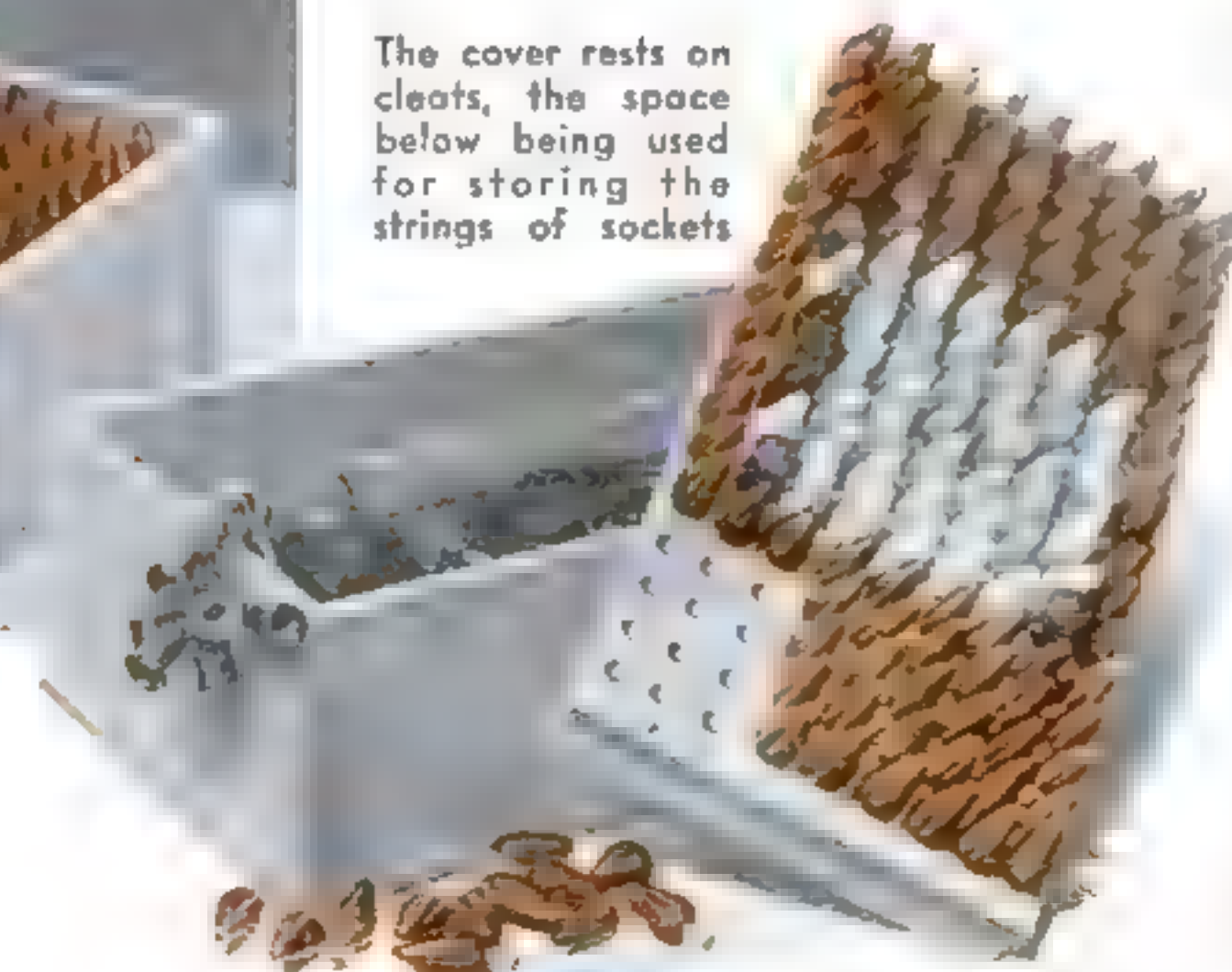
The chime works best on direct current obtained from two or three dry cells. Conventional doorbell transformers do not seem to operate the striker with adequate force, although any transformer that delivers 150 or more watts at between 5 and 6 volts is satisfactory. However, transformer operation causes a slight buzzing of the armature, which may be objectionable unless muffled by close adjustment and perhaps the addition of a piece or two of thin rubber. If dry cells are used, the volume of tone is largely a matter of selecting the proper bar and adjusting the device.

Storing Christmas Light Bulbs so They Cannot Break



The cover rests on cleats, the space below being used for storing the strings of sockets

A box large enough to hold all the bulbs, cords, sockets, and accessories is made and fitted with a set-in cover, which is drilled to suit the Christmas-tree lamp bases



THE problem of storing Christmas-tree lamps to prevent breakage can be solved by constructing a wood or plywood box as shown and fitting it with a set-in cover drilled with holes to receive the bases of the bulbs. Below this cover is ample room for storing the cords, switches, and other accessories.

Round up the Christmas cords and bulbs to get an idea as to the size box necessary to hold them all. The cover should be cut to slide inside the box and rest on wooden cleats, which are placed low enough to allow the tops of the bulbs to align with the top of the box so that another cover may be put on, if desired. Complete the box by painting it.—WALTER MASSON.

FURNITURE



The drafting table is set up on the built-in bookcase as shown at left. It is stored away flat when not required.

Folding Drafting Table Supported on a Bookcase

WHEN you have occasional drafting to do, it is convenient to have a drafting table that can be set up in a good light, will be solid while you use it, and can be folded flat and stored out of the way at other times. The table illustrated was designed to meet these conditions. It is used in combination with a built-in bookcase.

In addition to the usual shelves, the bookcase has three drawers: *A*, 1 $\frac{3}{8}$ by 17 $\frac{7}{8}$ by 12 in. for scales, triangles, and flat instruments; *B*, 4 $\frac{3}{8}$ by 17 $\frac{7}{8}$ by 12 in. for ink, instruments, and supplies; and *D*, 5 $\frac{1}{2}$ by 7 $\frac{5}{8}$ by 12 in. for filing 4 by 6-in. index cards. Space *C* is used for a supply of letter-size bond paper.

Two steel plates $\frac{1}{4}$ by 1 $\frac{1}{4}$ by 1 in., drilled for No. 10 flathead wood screws, are set into the top of the bookcase flush with the surface where indicated.

The drafting table was made from yellow-pine flooring, which happened to be on hand. Any of the ordinary woods could be used. Cut the pieces as shown on the list of materials.

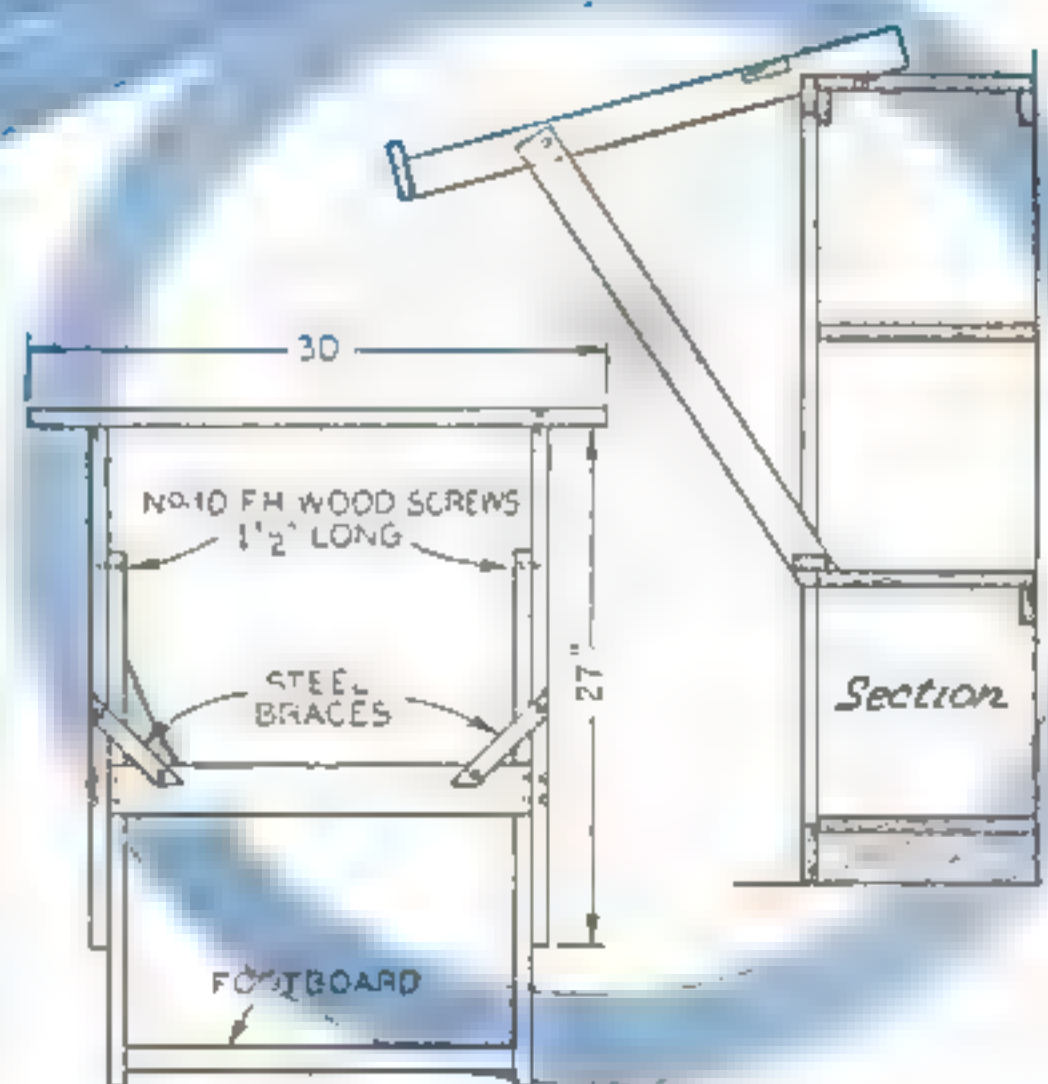
On each of the 27-in. rails, measure 20 $\frac{1}{2}$ in. from the front end, and 1 $\frac{1}{4}$ in. from the lower side. Make a 3 $\frac{1}{4}$ by

12-in. rafter cut. Measure 3 $\frac{3}{4}$ in. from the heel of the cut and put a 1 $\frac{1}{2}$ -in. No. 10 wood screw in till the threads are covered. Cut off the head and file the shank smooth; it is to enter the hole in the steel plate on the bookcase.

In the two legs, drill and countersink a hole in each to take the No. 10 screw that acts as a hinge in folding the table. Make a 7 $\frac{3}{4}$ by 12-in. rafter cut at the end of each leg to fit the shelf of the bookcase. Assemble the table with screws. The diagonal braces of $\frac{1}{4}$ by 1-in. steel were used so the table would fold flat, but braces of wood may be substituted.

The bookcase and table were finished with a good grade of four-hour brown enamel. First, however, the wood was thoroughly sandpapered, dusted, and primed with flat white wall paint which

How the bookcase is built and, at right, drafting-table frame



had been colored a light brown by tinting it with burnt umber in oil. A brown wall paint or brown enamel undercoater might have been used instead.

A "rafter cut," mentioned before, is the diagonal of a right-angled triangle having legs of the stated dimensions. Approximate angles are given in the plans.—F. D. OLNEY.

(The list of materials for this project will be found on page 116.)

PLANS Building Convenient Places to Keep Books, Drafting Equipment, Silverware, and Plants

A Three-Drawer Silverware Chest for Use on Buffet

SILVERWARE often has to be kept in unhandy places, but not if you construct a chest like the one illustrated. It resembles an old Georgian Colonial writing cabinet of the eighteenth century, yet you may place it with almost any period or color of furniture. The original cabinet is solid mahogany, finished a deep, lustrous red.

First, measure your longest pieces of silverware and stack the others in piles so as to assure yourself that the cabinet is large enough for your purposes; if not, increase the dimensions as necessary.

Form each of the casings for the two outside drawers from three pieces of lumber—two outside ends of $\frac{3}{8}$ -in. mahogany, $2\frac{7}{8}$ by 11 in., two inside pieces $2\frac{7}{8}$ by $10\frac{3}{4}$ in., and two bottoms $4\frac{1}{2}$ by 11 in. In the rear edges of the two outside pieces cut $\frac{1}{4}$ by $\frac{1}{4}$ -in. rabbets into which the back will set. These two sections are glued together in the form of two separate units and appear merely to be boxes without ends or tops. Next cut a strip $2\frac{1}{2}$ by $19\frac{3}{4}$ in. for the back, and a nicely grained solid panel for the top, 11 by 20 in. (Continued on page 116)



The cabinet with drawers drawn out to show arrangement of silverware. Right, lining racks with velvet



Tall Turned Flowerpot Stand Has Slim, Graceful Lines



MADE of any close-grained cabinet wood, such as mahogany, walnut, gum, maple, or birch, this flowerpot stand forms an attractive addition to the living room.

Turn the two parts of the column, making the lower section first, but before turning this part, bore the 1-in. hole and make a plug about 3 in. long to insert in it. Set the center mark of the plug accurately on the dead center of the lathe so the work will turn true. Reed the column by using the lathe's dividing head and a portable shaper; or else mark by hand, place in a jig, and carve with a chisel.

Lay out the legs and cut to shape, rounding the upper edges. To obtain a perfect fit against the column, sand ends of legs on a $2\frac{1}{2}$ -in. diameter cylinder to which sandpaper has been glued.

Make the top from a disk $2\frac{1}{2}$ in. thick and a little over 10 in. in diameter. Turn the top of the disk first, then remove it from the faceplate, and make a wooden chuck into which it will fit tightly. Complete the turning, including the 1-in. hole for the upper end of column. French polish all parts except the legs in the lathe while it is turning at its slowest speed.

Glue one leg at a time.—HERMAN HJORTH.

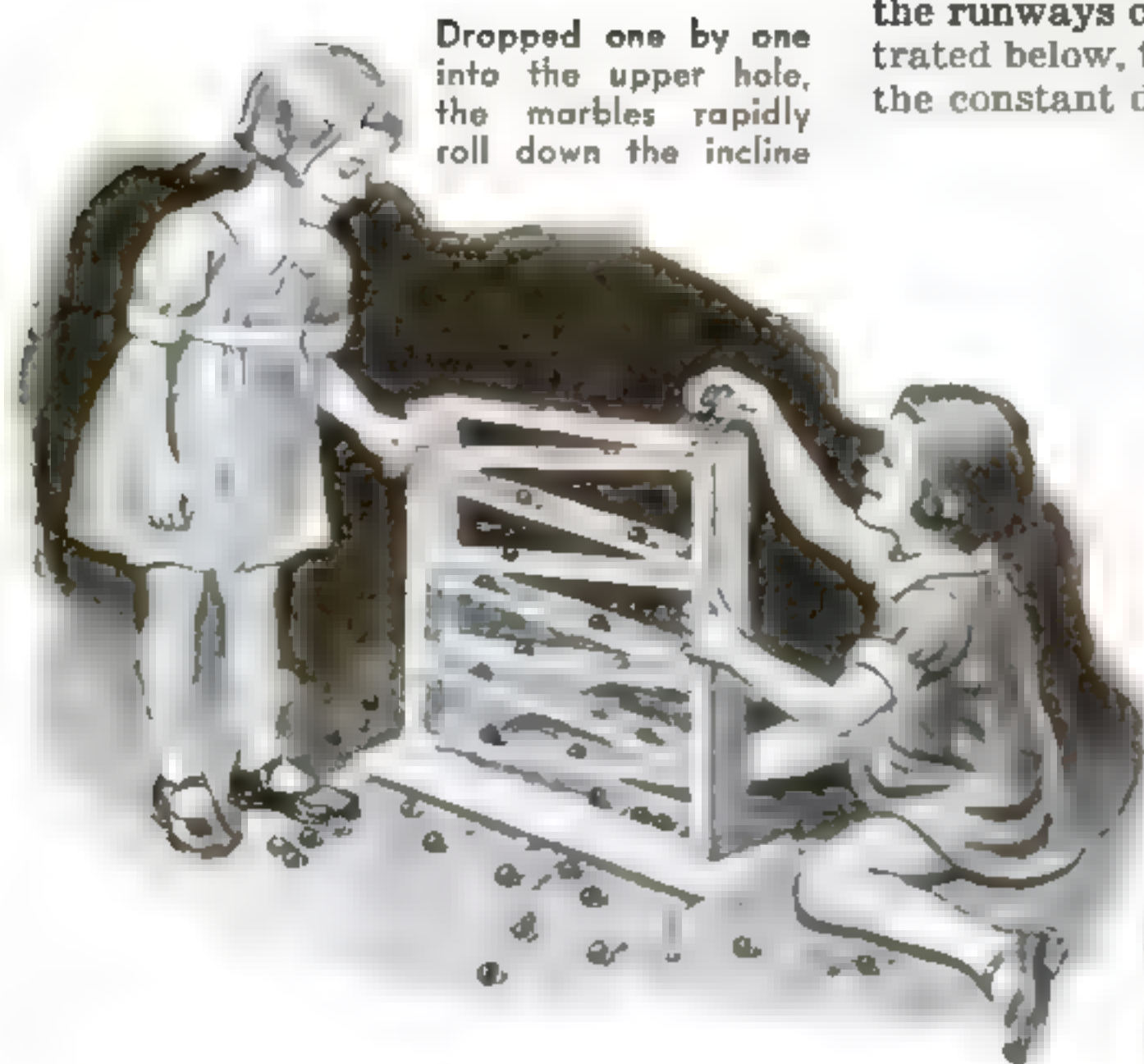
Rolling-Marble Game Amuses Children

WHEN three dozen or more brightly colored marbles are rolling down the runways of the homemade toy illustrated below, the motion, the sound, and the constant dropping of the balls com-

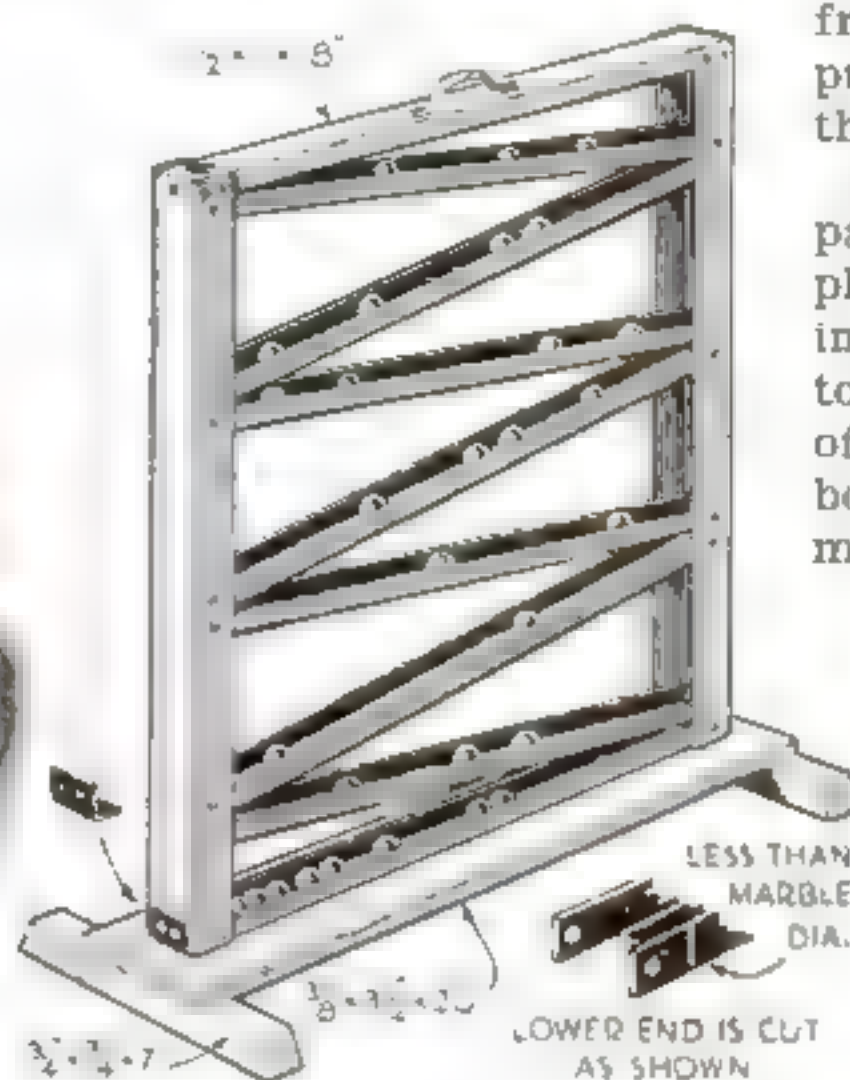
bine to hold the attention of small children for a long time. Unlike more mechanical and automatic toys, it gives them a chance to match their finger dexterity with the rolling marbles, because they have to take the marbles from the receiver at the bottom and put them into the hole at the top so that the rolling will be continuous.

The toy requires twenty-one parts, but they are all of the simplest variety. Make the frame 18 in. square, and use $\frac{1}{2}$ by 1-in. pieces to support the runways, which are of thin metal fastened with small bolts. If desired, an extra runway may be inserted and all the runways tilted a trifle less so that the marbles will roll less rapidly.

Paint the incline some pale color so as not to distract from the glitter of the glass marbles, which should be the brightest obtainable at any toy store.—D. C.



Dropped one by one into the upper hole, the marbles rapidly roll down the incline



Float Valve for Furnace Water Pan

IN VERY cold weather it is usually necessary to fill the water pan in a hot-air furnace several times a day in order to provide necessary humidity. Also, the humidification is most efficient when the pan is kept filled nearly to the top.

An efficient float valve to take care of this chore can be easily made from an old inner-tube valve and a few odds and ends. Remove the core, and saw off enough of the end of the valve to allow the valve stem to protrude about $\frac{1}{16}$ in. when the core is fully seated. If the threads are damaged in this process, they may be straightened with the tap of an ordinary valve tool. Insert the core again and screw up until seated.

A piece of brass rod or heavy copper wire about 10 in. long forms the float arm. It should be flattened with a hammer about $\frac{1}{4}$ in. from the end, and drilled as shown to form a bearing. The short end is flattened at right angles to bear against the valve stem.

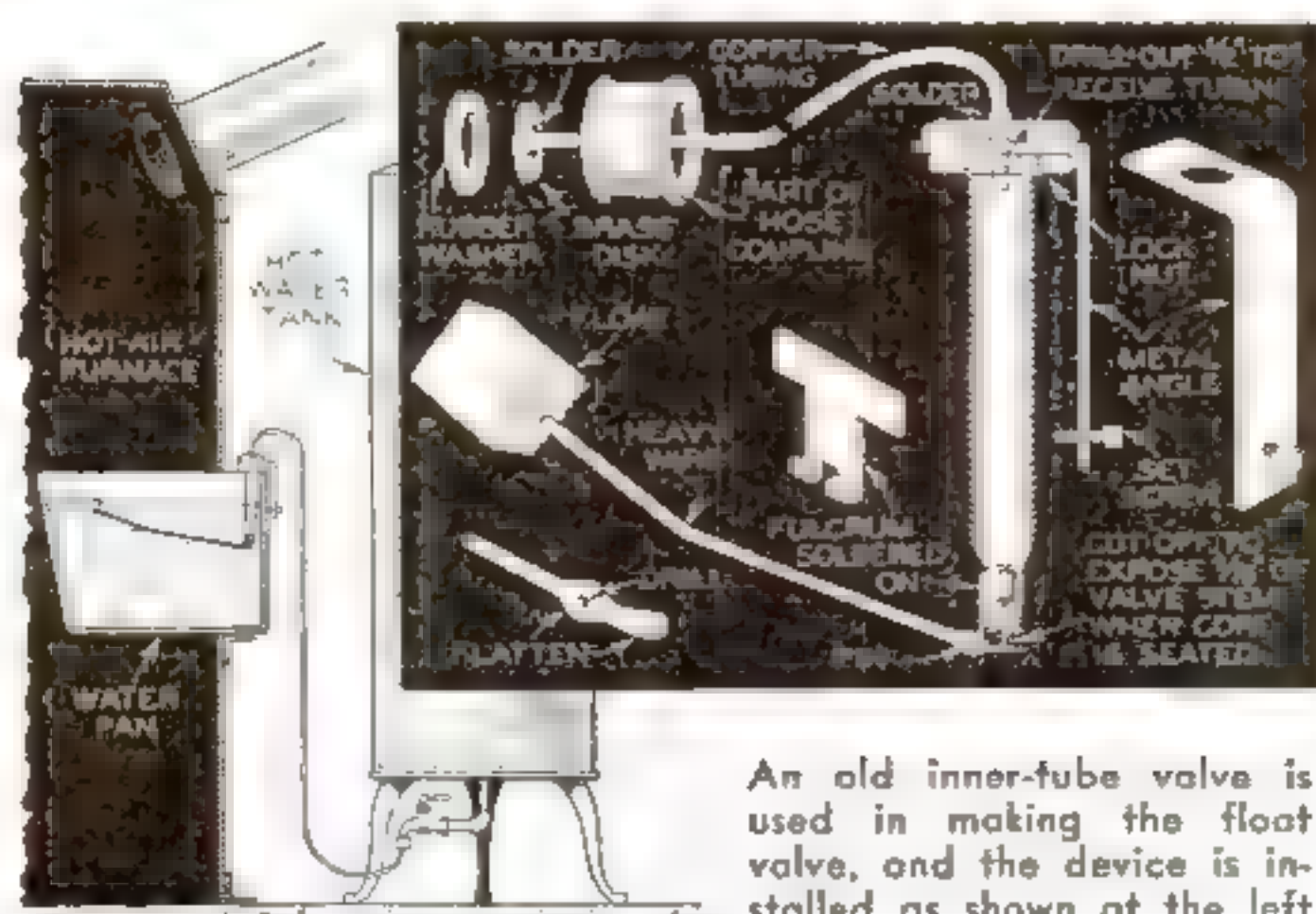
The fulcrum is made from a T-shaped piece of brass or copper, shaped as shown and soldered to the valve. The float may be a ball or a block of wood with enough buoyancy to support the float arm in water. For holding the valve in place against the side of the water pan, a strip of metal is bent at right angles and drilled to fit over the valve, where it is held in place with the valve lock nut. The lower end is drilled and tapped for a set screw.

The valve should be connected to the

water supply by a length of copper tubing. The diameter of the tubing does not matter as the flow of water through it is very small after the pan is once filled. Drill the inside end of the valve body large enough to receive the tubing for about $\frac{1}{2}$ in. and solder in place. The tubing may be connected to a faucet by soldering to its end a brass or copper disk that will fit inside an old hose coupling. A soft rubber washer makes the connection water-tight.

In most homes a convenient connection can be made to the drain faucet at the bottom of the hot-water tank. If, however, a water connection is not available, the valve may be connected to a supply tank of several gallons capacity set on top of the furnace, hung from the ceiling, or put in any convenient place that is higher than the furnace water pan.

After the valve is in place in the water pan, it may be adjusted to maintain exactly the correct water level by bending the float arm and experimenting until it is right.—H. W. TETER.



An old inner-tube valve is used in making the float valve, and the device is installed as shown at the left



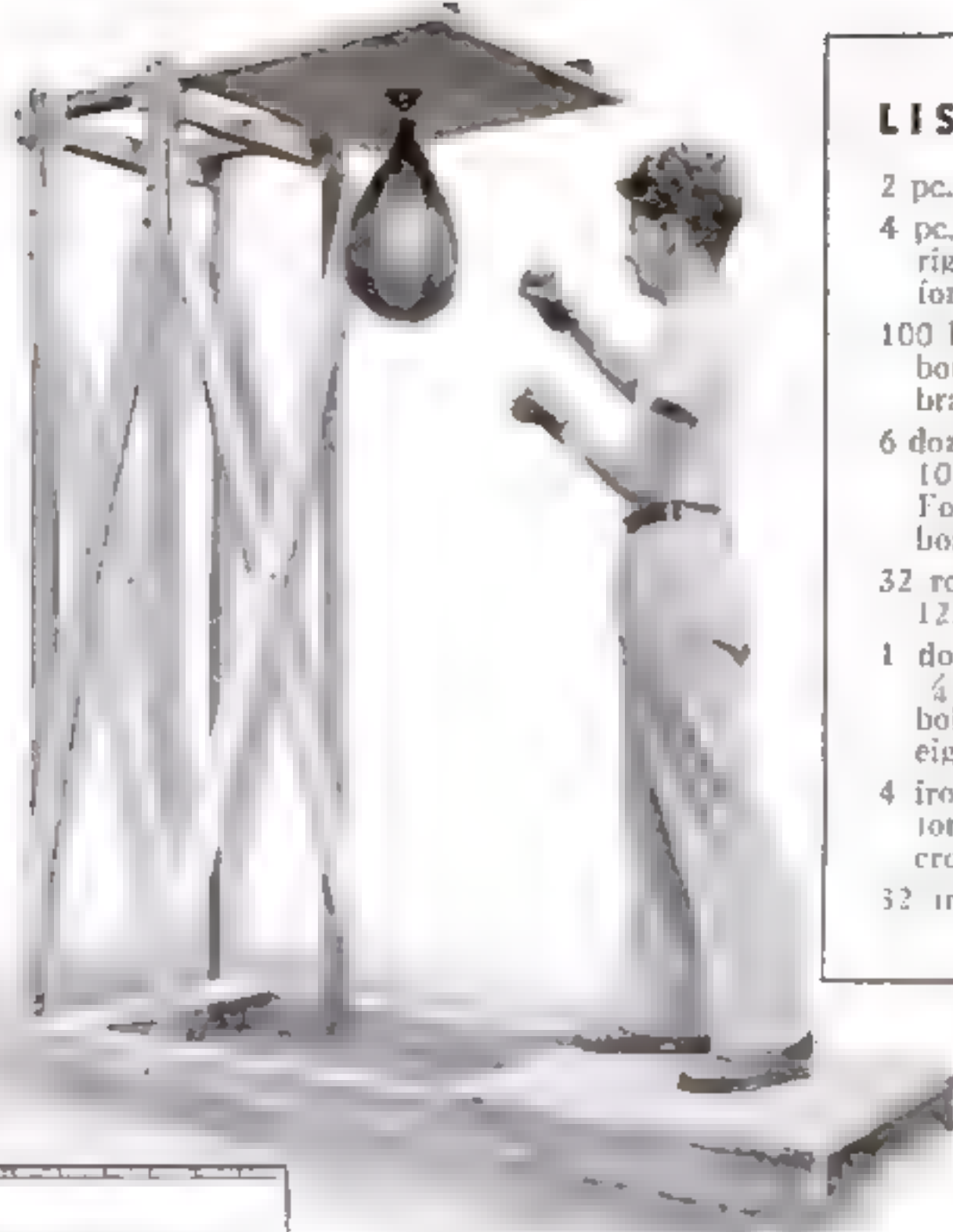
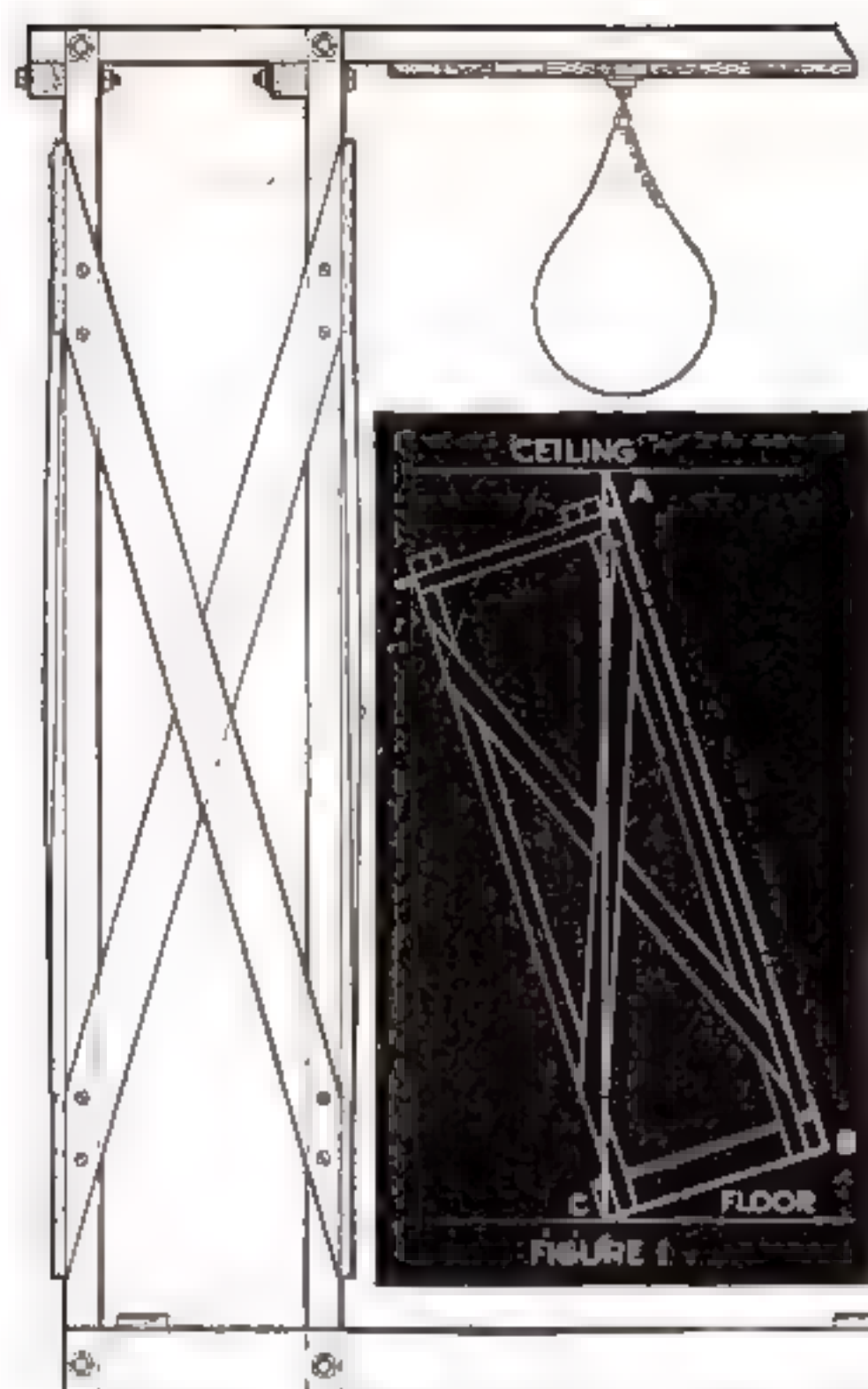
Soldering Copper Set in Pan for Heating

FOR household soldering jobs, many home mechanics have to rely on an ordinary soldering copper heated over a gas, gasoline, or kerosene stove. Such an open flame, however, does not keep the soldering iron hot enough, especially if it is a large one. To overcome this trouble, I retain the heat with a tin bread pan about 10 in. long, 5 in. wide, and 4 in. deep, lined on the inside with about six layers of the sheet asbestos used for covering furnace casings and pipes. Pasting in the sheets gives a neater job and permits the use of scrap pieces, but the actual fastening must depend on metal strips or buttons held by rivets, small stove bolts, or nails driven through and clinched.

The soldering copper is put through a hole cut in one end of the pan, and the tip rests in a similar hole in the other end. A wider tin would permit the heating of two coppers at the same time.—I. W. DICKERSON.

Magnets Hold Work for Welding

MAGNETS taken from old magnetos, which may be found at any junk yard, are handy around the welding shop or garage. With the magnets, many welding jobs may be held together without clamping or blocking.—EARL FOX.



LIST OF MATERIALS

- 2 pc. 2 by 4 in. by 6 ft. for base.
- 4 pc. 2 by 2 in. by 6 ft. 8 in. for up-rights, and 2 pc. 2 by 2 in. by 4 ft. for rebound platform.
- 100 lineal feet $\frac{3}{4}$ by 3-in. for floor, rebound platform, and eight diagonal braces. Spruce is best, if available.
- 6 doz. flathead wood screws, $1\frac{1}{4}$ -in. No. 10, for floor and rebound platform. Four screws are to be used for each board.
- 32 roundhead wood screws, $1\frac{1}{4}$ -in. No. 12, for fastening the diagonal braces.
- 1 doz. squarehead iron bolts, $4\frac{1}{2}$ by $\frac{1}{4}$ in., with nuts. Four are used to bolt the uprights to the base, and eight to bolt on the rebound platform.
- 4 iron bolts, $2\frac{1}{2}$ by $\frac{1}{4}$ in. with nuts, for use where the diagonal braces cross each other.
- 32 iron washers and 16 lock washers.

PORTABLE Punching-Bag Stand REDUCES NOISE AND VIBRATION

ANY boy who has ever had a punching bag knows how hard it is to find a good place to hang it. If he suspends the rebound platform from the beams in the cellar, the vibration and noise resound through the house. If he hangs it in any of the rooms upstairs or in the attic, it is even worse. And if he lives in an apartment, the landlord will not tolerate the defacement of ceiling or walls. The neighbors are also almost certain to complain of the racket, even if the landlord does not object.

Of course, the garage, if one is available, can sometimes be used; but usually, when the car is in, there is not enough room to do any bag punching. Besides, some garages have no lighting connections, and so it would be impossible to use the bag in the evening.

This punching-bag stand circumvents all of these difficulties. It is an independent unit, not attached to either walls or ceiling, and it has the added advantage of being portable. Thus it is available for use outdoors in fine weather and indoors at other times.

The stand illustrated is 6 ft. 8 in. high, and the base is 6 ft. long. The height must be a few inches shorter than the distance between floor and ceiling of the room where the stand is to be used. If the ceiling is low, the proper height can be found by drawing a right-angle triangle as shown by the dot-and-dash lines in the small diagram. Line AC, the hypotenuse, represents the distance from ceiling to floor; CB is the

width, or 30 in.; and AB is the maximum height. Better make it an inch or two less.

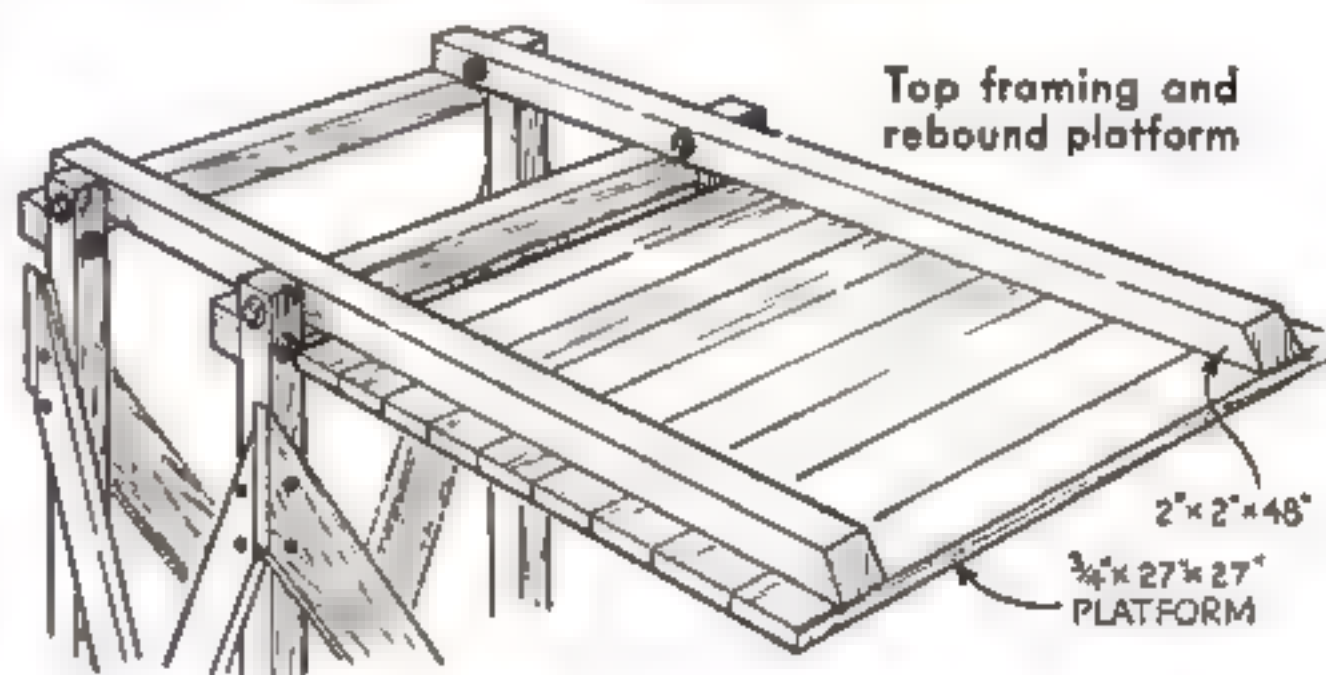
In any case, the bag should hang at about the head level of a man 6 ft. tall. Then, if a short boy wishes to punch it, he can stand on a box large enough to bring his head level with the bag.

Cut all the wood to length except the eight diagonal cross braces. Screw the nine pieces that form the floor to the two 6-ft. 2 by 4's. To the latter bolt the four upright

corner pieces. Next screw the nine pieces of the rebound platform to the two 48-in. 2 by 2's that form the top, and bolt the upper assembly to the top of the four uprights. All this may be done while the structure is lying on its side.

Finally, cut the diagonal braces and screw them in place, making sure that the pillar is square. It will be found that these braces are sufficiently springy to cross each other without making a cross-lap joint. Simply put one of the $2\frac{1}{2}$ -in. bolts

through each pair at the center. Total cost to the writer on Long Island, N.Y., was \$3.40.—BERTRAM BROWNOLD.



Salvaging Glasses with Broken Stems



WHEN goblets and other pieces of crystal ware are accidentally broken at the stem, you can easily turn new wooden bases on the lathe from wild cherry, maple, cedar, birch, walnut, or other decorative, close-grained woods. One of many patterns for such bases is illustrated.

A hole is drilled in the top of each wooden base large enough to contain the broken stem. The base is then thoroughly sanded, stained, given a very thin coat of shellac, and finished with waterproof and alcohol-resisting varnish. The holes are filled with waterproof casein glue, the broken stems pushed into them, and the excess glue removed.—ELISABETH FROST MINER.

Throwing the 'Snow Snake'

IS NOVEL WINTER SPORT



"SNOW SNAKE" is one of the oldest winter games played by our American Indians. The contestants throw a long spear in such a way as to slide along the smooth snow or in a groove made in the snow by pulling a log along the course. Points are given the one who throws the farthest. The game may also be played by teams.

The "snake" used by the Indians was usually 10 ft. long, but for the average boy or girl, from 4 to 6 ft. is long enough. Use hickory or ash 1 to 2 in. in

diameter, if available. Remove the bark and shape the stick with a knife or a plane as shown at A. Paint the head to represent a snake. If added weight is needed, drill a hole into the back of the head and pour in melted lead. The flat back should be decorated with designs as suggested at B. These may be painted, carved, or burned in.

The player stoops over, holding the stick as at C, and hurls it with a long sweeping throw. It may also be thrown overhand as shown above.—GRAY WOLF.



How the "snake" is shaped, decorated, and held. Upper left, using the overhand throw



Board on Jig-Saw Table Helps in Small Work

WHEN sawing very small pieces on a jig saw, it is sometimes difficult to keep the work from catching on the edges of the blade opening. This can be overcome by sawing to the center of a scrap of $\frac{1}{4}$ -in. veneer about 8 in. square and clamping it to the saw table as above. The plywood also acts as an extra guide for the blade.—NEIL NELSON.

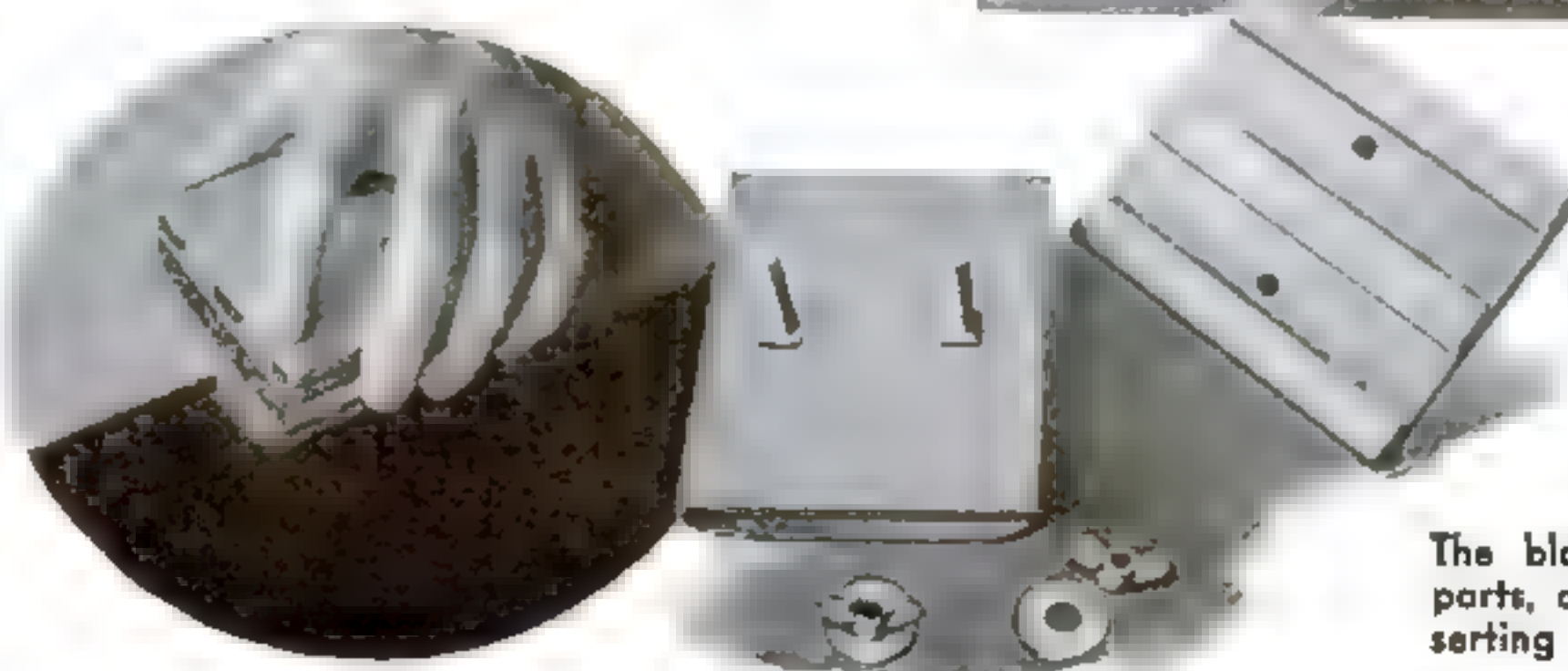
Sanding Block Faced with Sponge Rubber

THE sanding block illustrated is excellent for sanding varnish, lacquer, or shellac between coats because it prevents sanding through at high spots and missing the low spots.

Cut a piece of sponge rubber $\frac{5}{8}$ by $3\frac{1}{2}$ by $4\frac{1}{2}$ in. from an old rubber kneeling mat, and also a piece of plywood $\frac{1}{4}$ by $3\frac{1}{2}$ by $4\frac{1}{2}$ in. Mount two flathead stove bolts about $1\frac{1}{2}$ in. long on the wood as shown, and glue the rubber to the underside. Cut another piece of plywood the same size and glue to one side three strips of wood $\frac{1}{2}$ in. wide and $\frac{3}{8}$ in. thick. Bore holes for the bolts.

This sanding block takes a quarter

sheet of standard-size sandpaper. Lay the pad on the paper, bringing the two projecting ends up as indicated, and hold in place with the top, which is fastened by means of two wing nuts and washers.—ROLLIN H. WAMPLER.



The block in use, its parts, and, above, inserting the sandpaper



One of three shallow knife drawers added to the old cabinet in space gained by substituting narrower rails

COMPACT, serviceable, beautiful — that's the modern kitchen cabinet. If yours falls short of this ideal, you can bring it up to date by making changes similar to those illustrated.

The "before and after" drawings show how the writer improved his cupboard. The roughly made doors, marred by cracks in the solid wood panels, were exchanged for flush doors of plywood. Replacing 4-in. wide rails and stiles between the drawers in the lower section with $\frac{3}{4}$ -in. members saved 7 in. in width and enough vertical space to accommodate three shallow knife drawers.

Since there was no room in the small kitchen for a mechanical refrigerator, an ice box was cut down to fit under the drain board. An open space was left under the sink to comply with sanitary regulations, but a linoleum-covered shelf was built in 6 in. above the floor to hold a box for vegetables and another for cleaning materials. The doors of this sink section are short to give toe room and ventilation.

Throughout the cabinet additional shelves were placed close together to increase the dish room, and spice cabinets were added above the sink. The left-over space between ice box and wall serves as a broom closet.

In revamping a cupboard, first check it with a level to see if it is true. Faults must often be left "as is" and the new work

(Continued on page 117)

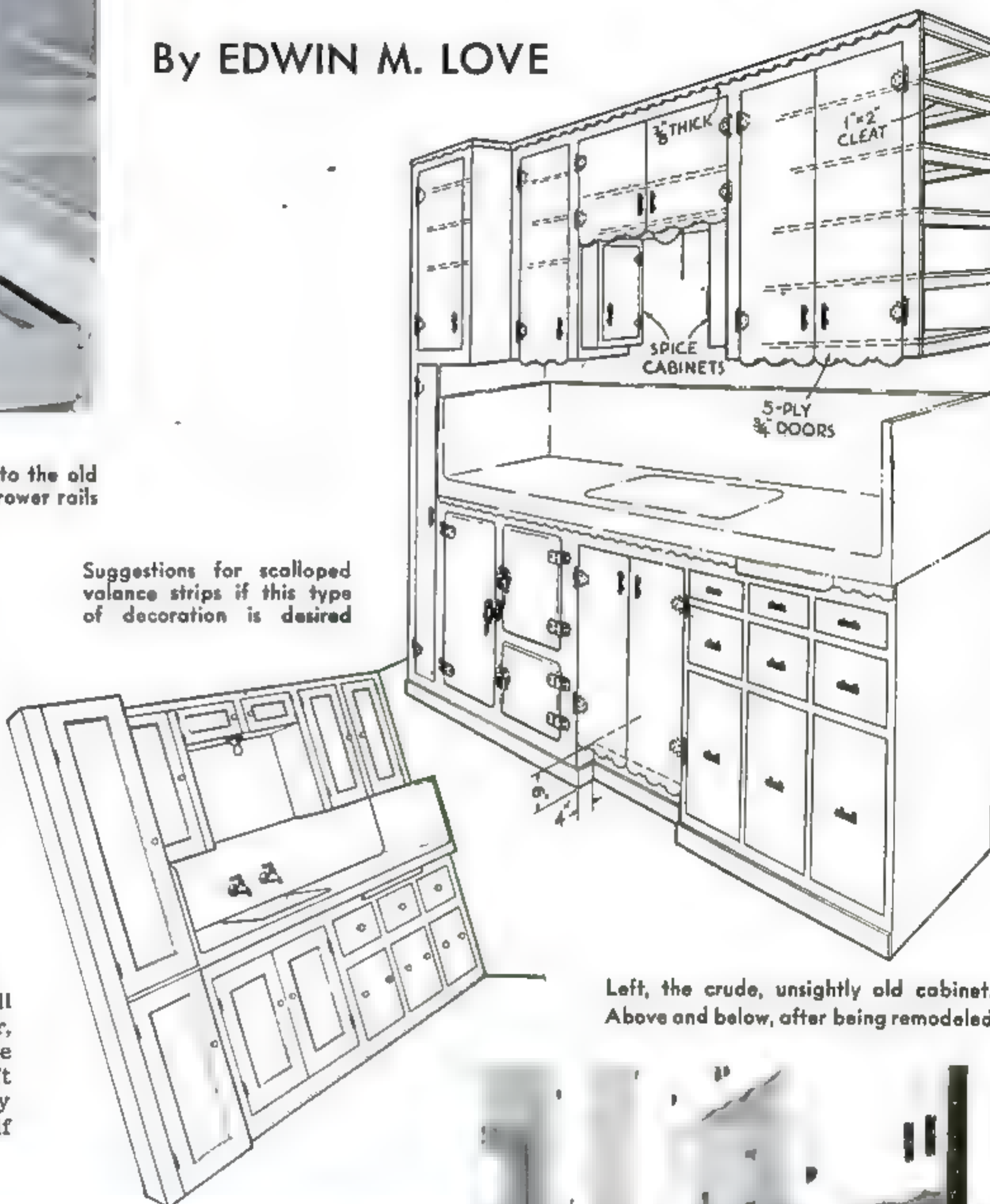
Modernizing

AN OLD

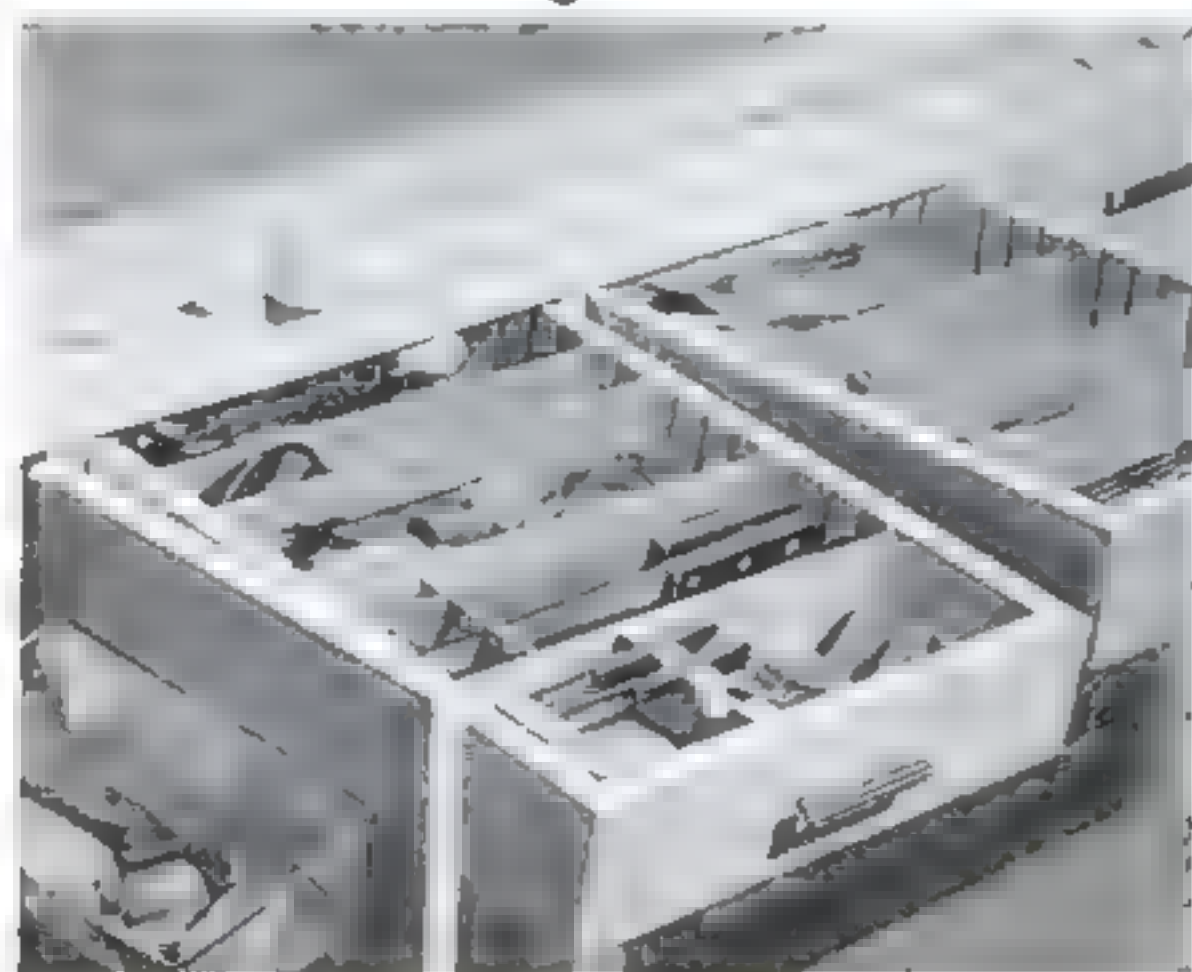
Kitchen Cabinet

By EDWIN M. LOVE

Suggestions for scalloped valance strips if this type of decoration is desired



Left, the crude, unsightly old cabinet. Above and below, after being remodeled



Mystery Plane

HOW TO MAKE A SOLID SCALE MODEL OF THE ARMY'S HIGH-POWERED NEW BELL AIRACUDA

By Donald W. Clark

THIS amazing new \$700,000 United States Army plane was designed to fight giant bombers and is believed to be the world's greatest and fastest aerial war machine (P.S.M., Oct. '37, p. 53). Known as the Bell Airacuda or the XFM-1, it carries a crew of five in heated cabins, six machine guns, small bombs, and a generating plant independent of the engines. The cockpits are interconnected with telephones. Superchargers and variable-pitch propellers make it possible to attain an altitude of 30,000 ft.

Until the plans are released by the Government, very little will be known about this huge mystery ship. The original plane was built by Bell Aircraft in secrecy under War Department directions. It was designed by Robert J. Woods.

The drawings given here were made from pictures published in newspapers and magazines. While they probably deviate in minor details from the closely guarded plans of the real plane, they nevertheless show the general lines and proportions with sufficient accuracy for a small model. Roughly, the span is about 65 ft. and the length about 43 ft. The maximum speed is estimated to be about 300 m.p.h. The plane is powered with two chemically cooled, 12-cylinder, V-type Allison engines rated at 1,000 h.p., which drive three-bladed propellers located at the trailing edge of the wings.

The model shown here is built to the scale of $\frac{3}{8}$ -in. equals 1 ft. and is made up of forty-two pieces, exclusive of wing pins. Our usual method of construction is followed, and you will find that the only difficult part of the job is shaping the rear ends of the nacelles.

Paint the entire plane aluminum, and use black for the windows, tires, hinge lines, lights, wing vents, guns, and other details. Color the insignia and vertical tail red, white, and blue as shown.

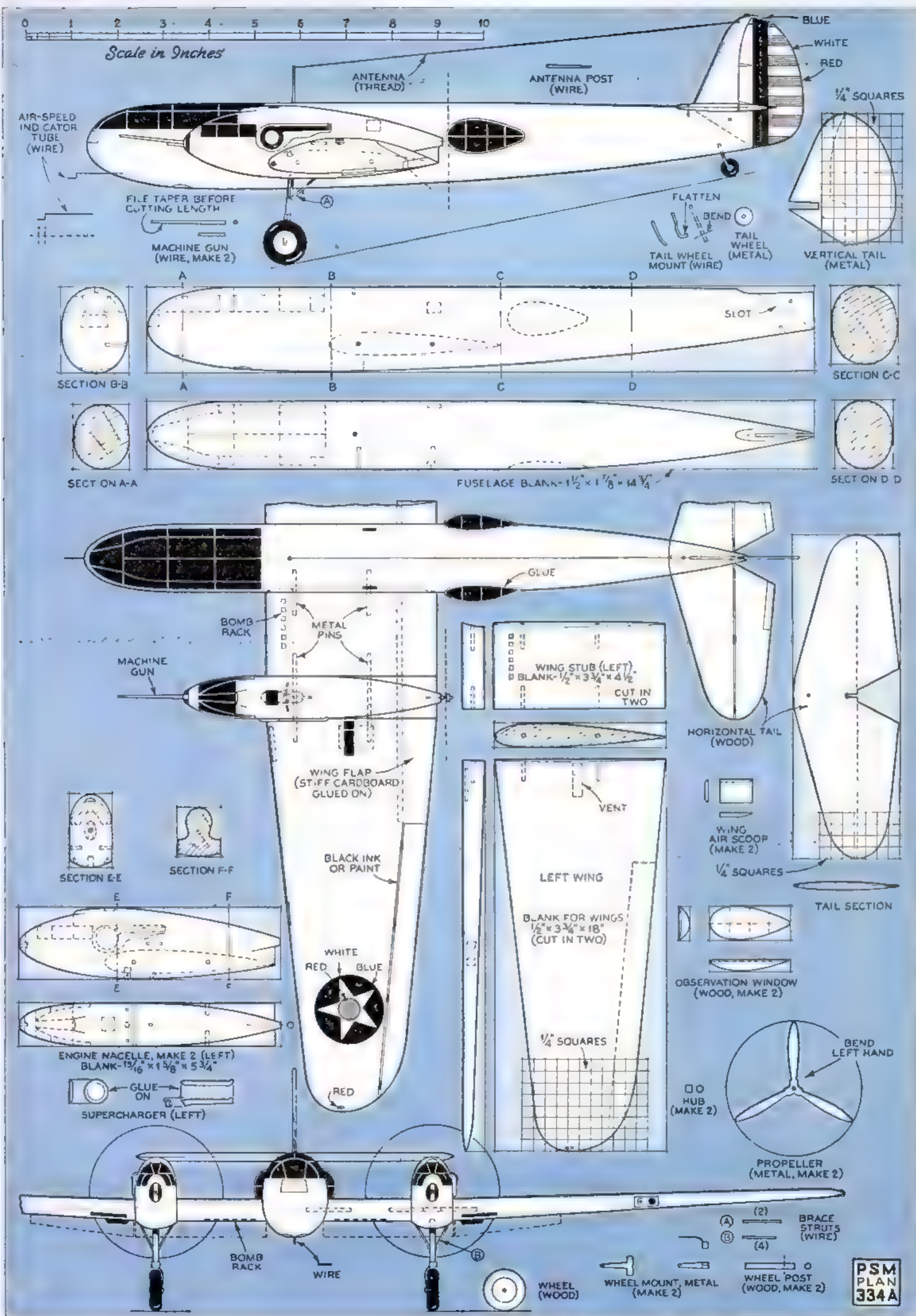


The finished model, which is shown at the left, has a span of $24\frac{1}{4}$ in. Above, fitting one of the engine nacelles. The individual parts are quite easy to construct if the drawings on the facing page are followed.



Built to shoot down giant bombers, the new plane has propellers located at the trailing edge of the wings





Rose-Petal Urn

TURNED FROM WALNUT
IN GRECIAN STYLE

By
Robert B. Dyer

BOVELY to look at and delightful to use, is this rich walnut rose-petal urn of graceful Grecian design.

The bowl. A walnut block 3 by 6 by 16 in. is needed. Cut it in two and glue the two halves together to form a piece 6 in. square and 8 in. long. One end must be perfectly square. Fasten this end securely to the lathe faceplate with large screws. Place it on the lathe, bring up the tailstock, and turn 6 in. in diameter without shaping it much beyond a cylinder.

Now hollow the inside by placing a 4-in. tool rest at right angles to the tailstock and using a round-nose chisel. Make the cavity at least 5 in. deep and $3\frac{1}{2}$ in. in diameter at the top, tapering evenly to about 2 in. at the bottom. Form a mouth opening $3\frac{1}{2}$ in. in diameter with a shoulder $\frac{3}{8}$ in. deep and $\frac{1}{8}$ in. wide. To furnish support and eliminate vibration, a core $\frac{3}{4}$ in. in diameter is left attached to the tailstock until the depth of the bowl is reached, after which it is cut off at the bottom. Now, with the bowl revolving, finish the inside with a French polish of shellac



The completed urn with an inlaid initial and carved handles. Above, turning the lid. Dyer has won several prizes with his turned work.



A NATIONAL
HOMEWORKSHOP GUILD
FEATURE

and oil. The bowl is then removed.

From a scrap of pine $\frac{1}{2}$ in. thick, turn a disk to fit snugly in the mouth of the bowl. Return the bowl to the lathe as before, with the disk in the mouth attached to the tailstock.

Turn the outside to shape, but with a working surface of about $\frac{1}{16}$ in. to be removed after the initial has been inlaid. Form a dowel at the bottom, $\frac{1}{2}$ in. in diameter and $\frac{3}{4}$ in. long.

Cut the desired

initial from $\frac{1}{4}$ -in. thick white holly, place it on the bowl where the best grain figure appears, mark around it with a scribe, and cut the outline lightly with No. 3, 4, and 5 carving tools. Remove all waste wood with a narrow No. 1 carving chisel. Fit the initial snugly into the groove, glue it, tie securely with strong twine, and remove the bowl from the lathe to dry overnight.

The stem. Materials: 2 pc. walnut to turn into cylinders $1\frac{1}{2}$ in. in diameter and $2\frac{1}{2}$ in. long; 1 pc. white holly and 1 pc. vermillion wood, each $\frac{3}{16}$ by $1\frac{1}{2}$ by $1\frac{1}{2}$ in. Mount first piece of walnut on a screw center; turn concave with fillet at each end, making fillet which is to fit next to the bowl a little larger than the other. In this end drill a hole to fit over dowel of bowl. On the end having the smaller fillet, form a dowel

like that on the bowl. Drill a $\frac{1}{2}$ -in. hole in center of the holly and slip it over the dowel just made.

Prepare the second concave walnut piece in the same way, except that the dowel is on the end having the larger fillet. Fit this next to the holly; then add the vermillion piece after drilling it to fit the dowel.

The base. Material: Walnut, 2 by $6\frac{1}{2}$ by $6\frac{1}{2}$ in. Turn it with round-nose and spear-point chisels.

(Continued on page 122)



The outside is roughly turned, then the inside is entirely finished.

Guild Clubs Play Santa Claus

TO NEEDY CHILDREN



Members of the Louisville (Ky.) Homeshop Club with some of the toys they constructed for local children. At left, miniature village built by a craftsman of Racine, Wisc.

dent of the *Coulee Dam (Wash.)* club at the annual meeting; C. E. Benjamin, vice president; P. R. Nalder, secretary. The club agreed to make tables, benches, and other pieces of furniture for a proposed new school. An exhibition of saw filing was the program feature at the following meeting.

A. C. Easton, professor of practical arts at the University of Nebraska, is conducting a class for the *Lincoln (Nebr.)* Homeshop Club. The members are building ottomans at present, and Professor Easton grades each man's work, offering constructive criticism. The next project will be folding lawn chairs, followed by wood carving and archery.

The *Oklahoma (Okla.)* Homeshop Club has obtained the county National Youth Administration shop as a meeting place. A discussion of wood carving, sculpture, and architecture, and a demonstration of paints and finishes were features of recent meetings.

Members of the Capital Homeshop Club, *Washington, D.C.*, visited the shop of Elwood L. Quinter recently. Plans were completed for a visit of the club to the Homeshop and Model-makers' Guild of *Richmond, Va.*

Plans for an informal hobby show have been made by the Kerrisdale Homeshop Club of *Vancouver, B.C., Canada*. Each member is to make something and bring it to the meeting without telling in advance what it is . . . The *Western Springs (Ill.)* Craftsman's Guild has been assisting the Community (Continued on page 113)

HOME workshop clubs throughout the United States and Canada have been working at full speed for the past three months making and repairing toys to be given away to poor children at Christmas. This is one of the major civic activities encouraged by the National Homeshop Guild, and advance reports indicate that approximately 10,000 toys were prepared for distribution among the underprivileged.

Sometimes the members of a home workshop club work together to make a single item in mass production. In 1936 the *Denver (Colo.)* Homeshop Club followed this procedure and turned out 408 hobbyhorses. Some clubs distribute the toys themselves; others work in cooperation with an

agency such as the Red Cross and the Salvation Army.

The *San Diego (Calif.)* Homeshop Club made the most toys last year—a total of 700—with the *Denver* club and *Saginaw (Mich.)* Homeshop Club tied for second place, each having constructed approximately 400. Other clubs in the higher brackets were *Dover (N.H.)* Homeshop Club and *Lexington (Ky.)* Homeshoppers, each 350; *Madison (Wisc.)* Homeshop Club, *Billings (Mont.)* Homeshop Club, *Walla Walla (Wash.)* Homeshop Club, and Civic Homeshop Guild of *Fort Wayne, Ind.*, each 300; *Bison Homeshop Guild of Buffalo, N.Y.*, 250; *Poconos Homeshop Club of Stroudsburg, Pa.*, 225.

E. Robert Hogan was elected presi-

Flintlock Pistol Model

WHITTLED FROM WOOD



Two of the carved wooden pistols may be made and displayed by mounting them on an oval wall plaque

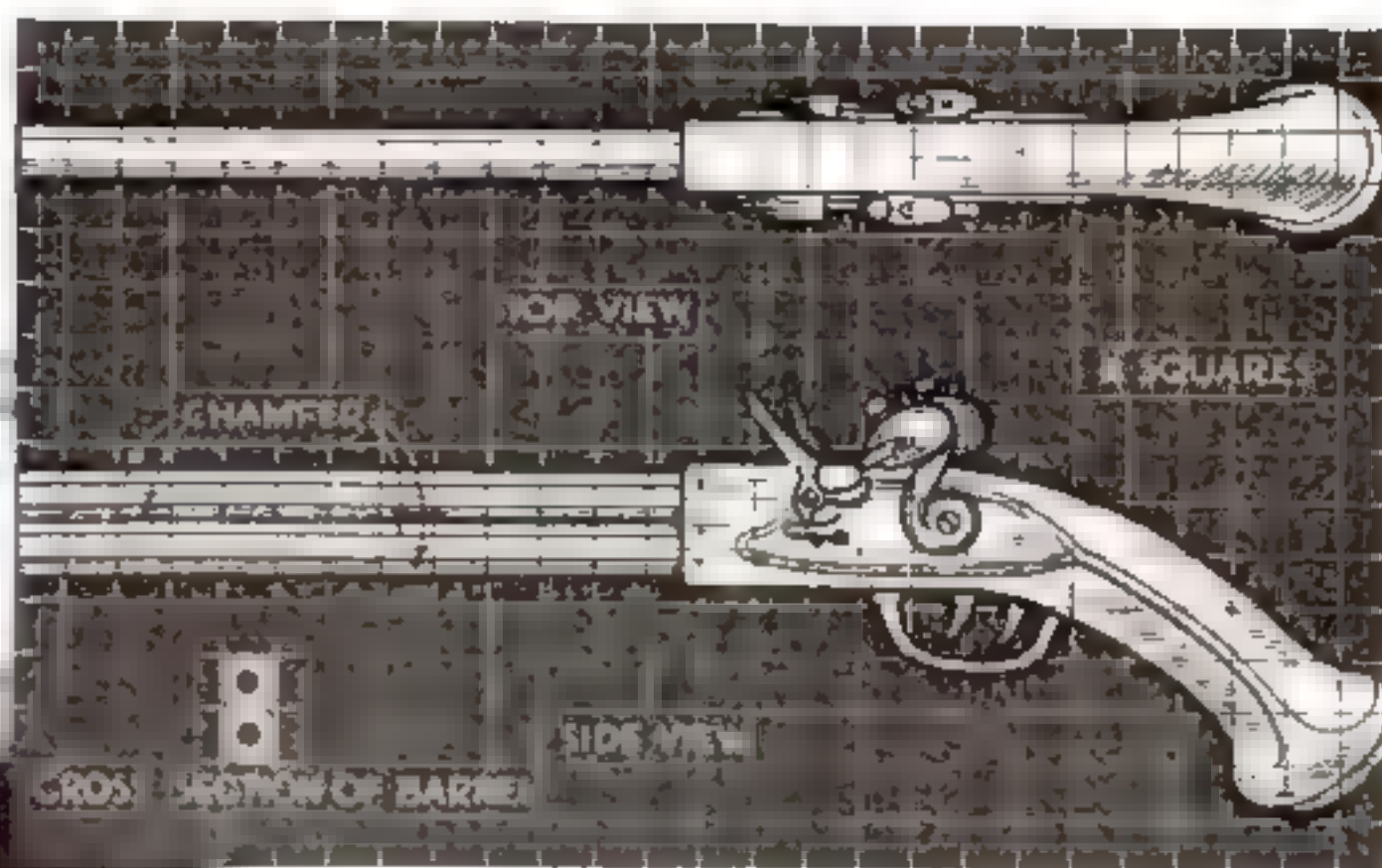
By E. J. TANGERMAN

SEVERAL readers have said recently that they would like to make models of historic firearms, either for a collection or as mantelpiece or trophy-room decorations.

It's really quite simple to whittle scale models from wood. The old-time Revolutionary War holster or belt pistol I have chosen for my first model is interesting because it is a double-barreled affair with one barrel over the other. It was probably brought to America by a British officer between 1756 and 1783, or possibly by some returning wealthy man.

My model, which is half size, requires a $\frac{3}{4}$ by $2\frac{1}{4}$ by $6\frac{1}{2}$ in. piece of straight-grained white pine or a harder, more decorative, wood. The work usually justifies the better wood, if for decoration. Draw the side outline, with the help of the squares, on the squared-up piece, and saw out the blank.

Before you begin whittling, study the relative proportions of barrel, trigger mechanism, and handle. Then do the rough cutting with a heavy pocketknife blade, thinning down the barrel portion to slightly under $\frac{1}{4}$ in. and the body just back of it to about $\frac{3}{8}$ in. At



The top and side views and a cross section to show the octagonal shape of the twin barrels



A sketch approximately full size of the model, but with parts on the far side omitted



ALTERNATIVE HEAD DESIGN

this point, mark in the trigger mechanism. Note that the projecting parts of each trigger mechanism are the roughly S-shaped hammer, the J-shaped flashpan, and the long-eared flashpan cover. I have drawn the model so that the hammers and flashpan covers are in slightly different positions, thus accenting the double-trigger arrangement.

Sharpen your knife-blade tip very carefully and press it into the wood

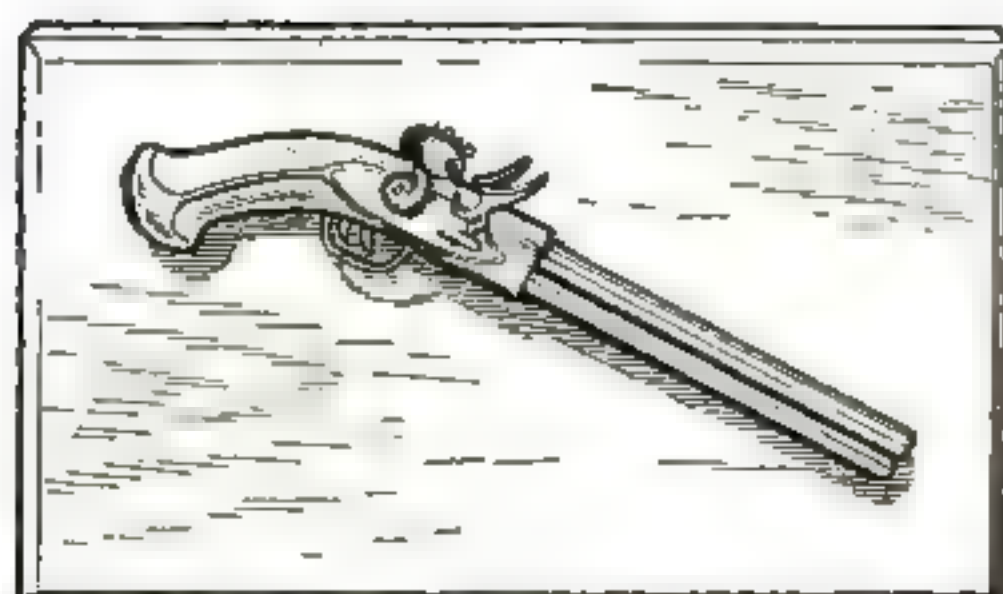
along the lines until you have scored each line deeply. Shape off the wood around the escutcheon plate, and begin to round the top part of the handle. Score along the pistol body just below the escutcheon plate and cautiously split off the wood outside the trigger guard on each side, until the guard is thinned to slightly over $\frac{1}{4}$ in. This clears the way for rounding up the handle. The original has a very definite line down each side, ending in a broadened part at the base or butt, so that the grip cross section is really not a circle, but a square with bulging sides.

In all this cutting, be careful not to grip the pistol (*Continued on page 121*)

The completed model, $6\frac{1}{2}$ in. long, is exactly half the size of the real weapon



The model may be mounted on a rectangular wood panel as shown at left



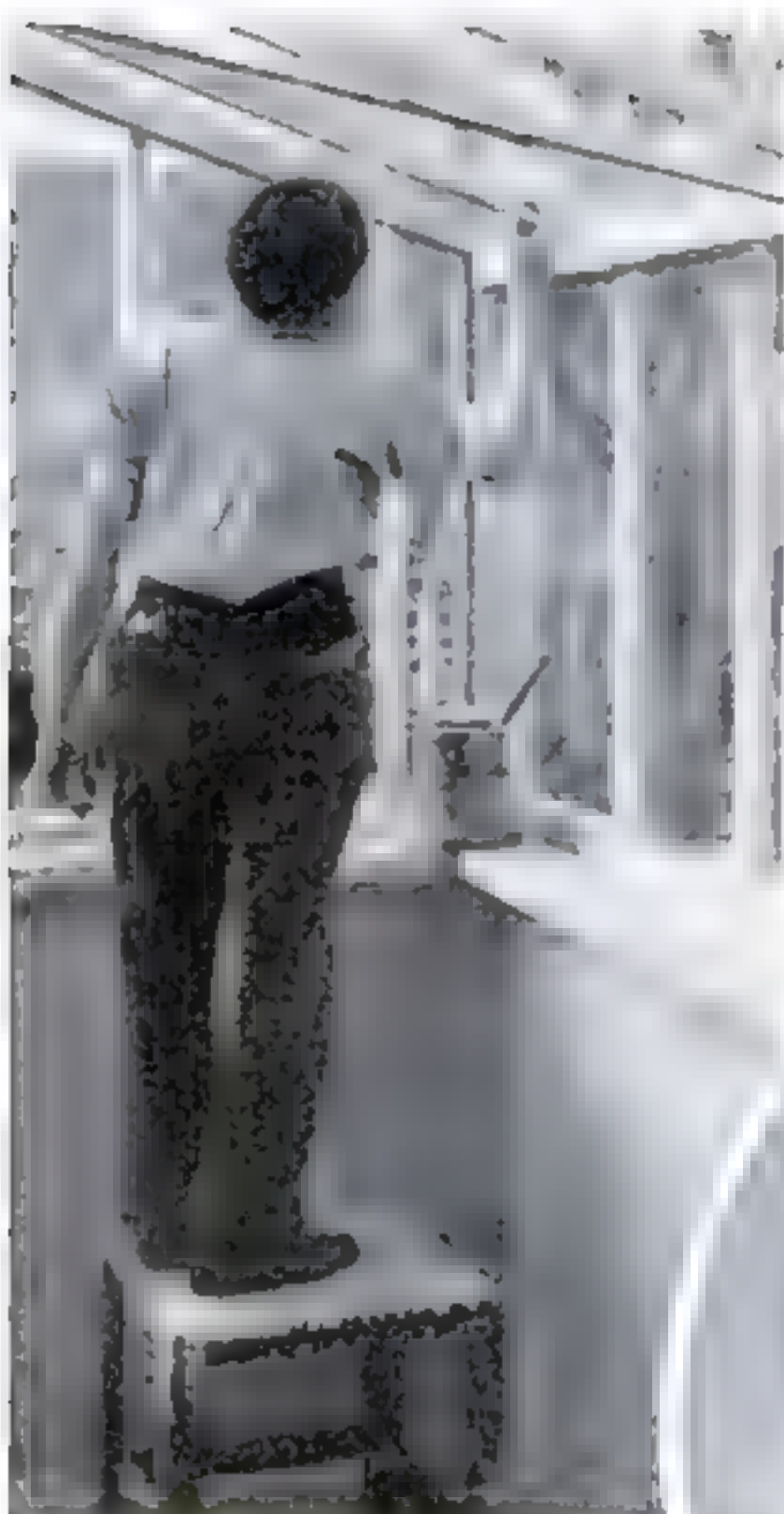
Although the pistol seems to be made of several parts, it is all one piece except for two small springs, and they can be drawn on with ink if desired



Small Greenhouses

AND HOW TO PAINT THEM

By Ralph G. Waring



The framework was primed with freshly mixed aluminum paint and finished, after glazing, with two coats of high-quality paint

NOW that men are beginning to appreciate the value of the garden-club programs their wives have so long enjoyed, more and more of them are constructing small greenhouses. In this work they are helped by the fact that greenhouse supply firms sell ready-cut plates, rafters, ridges, sash bars, transoms, and other parts, all made to standard sizes and adaptable for large or small greenhouses of either the gable or lean-to type. Catalogues and sample layouts can usually be had from such firms for the asking.

In my own experience, the cost averaged between \$1.50 and \$2.00 a square foot of glassed-in floor area, exclusive of labor.

Whatever type of construction is used, the painting is of the utmost importance, so I shall outline in detail the method used in finishing my own greenhouse. Winter, by the way, is a good time to do such work and is when I actually finished my greenhouse, although the photograph used at the beginning of this article was not taken until the following summer. (*Continued on page 124*)



The heating coils, hung on spacing strips, were cleaned with gasoline and alcohol and given a coat of enamel

Aluminum bronze mixed with a heat-proof varnish was used on the heater

CRAFTWORK



Cigarette Dispenser Works by Gravity

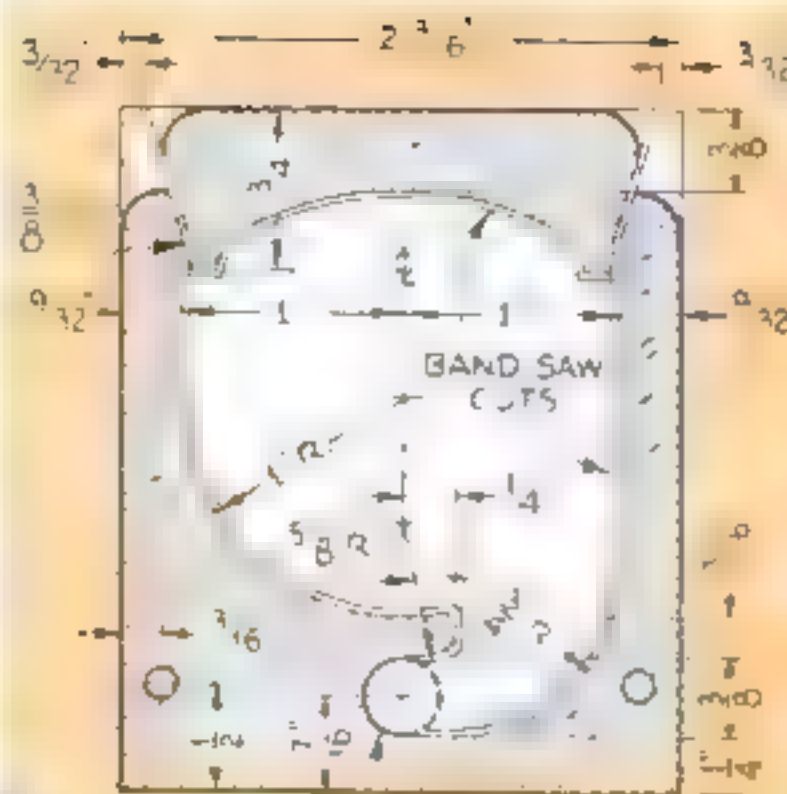
AFTER a cigarette has been ejected from the unique wooden dispenser shown in the illustration above, a slight shake sideways brings another cigarette in position to slide out. There are no moving parts to get out of order, and the whole can be cut from a solid block of wood or, if a more decorative effect is desired, from a built-up block of variously colored woods. The operations are as follows:

Glue up block of laminated wood as in drawings. Square to $2\frac{9}{16}$ by $3\frac{1}{2}$ by 4 in. Drill $\frac{1}{8}$ -in. dowel holes as shown. Band-saw off the end marked A. Lay out on end of body the outline of inside of box. Drill a $\frac{3}{8}$ -in. hole through body and end B. Saw off end B. Saw out inside and lid. The parts now appear as in one of the photos at the right above.

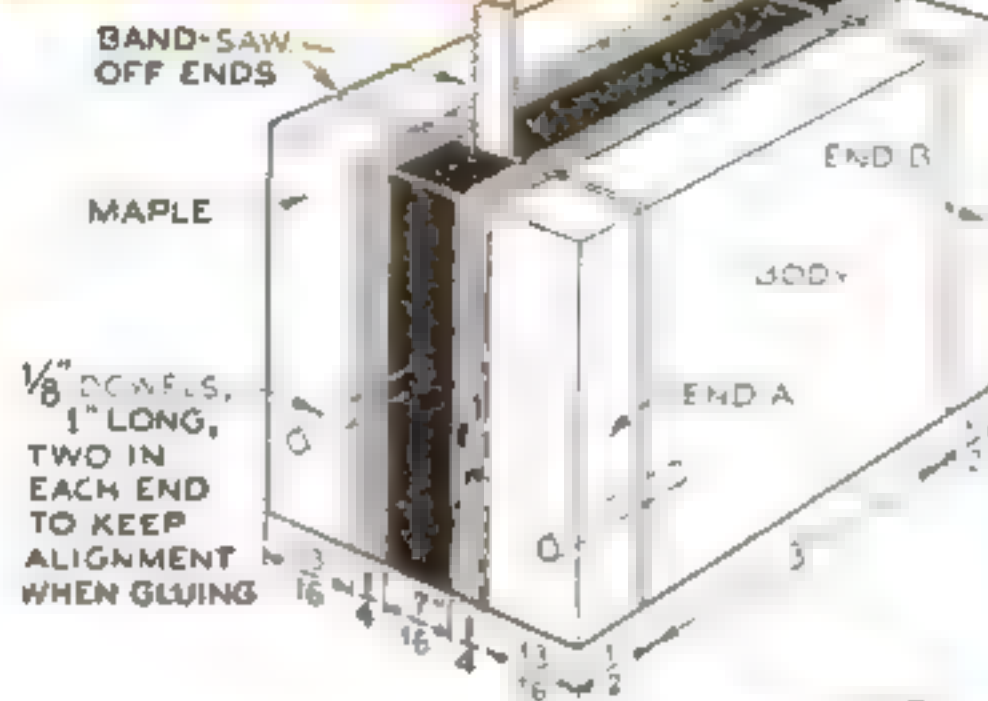
Sand the inside surfaces and enlarge the outlet hole to $\frac{7}{16}$ -in. diameter.

Glue the ends back to the body, using dowels to line up the ends while clamping. Cut about $\frac{3}{8}$ in. from the top of box. Fit the lid so it will snap into place, and round off the corners on a sanding disk. Sand and finish with several coats of thin, clear shellac and wax. If made of only one wood, it may be enameled.

As this is an attractive novelty that costs little for materials, does not require much handwork, and could be marketed for a dollar or less, it is suggested as a profitable item for quantity production in the small workshop.—JOHN P. ADAMS.



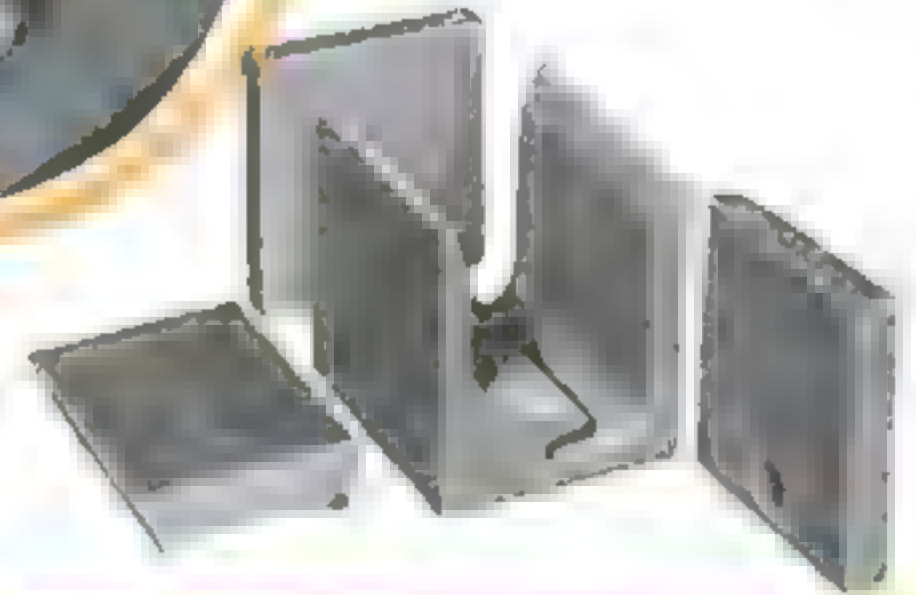
DRILL $\frac{3}{8}$ " HOLE THROUGH BODY AND END B



$\frac{1}{8}$ " DOWELS, 1" LONG, TWO IN EACH END TO KEEP ALIGNMENT WHEN GLUING



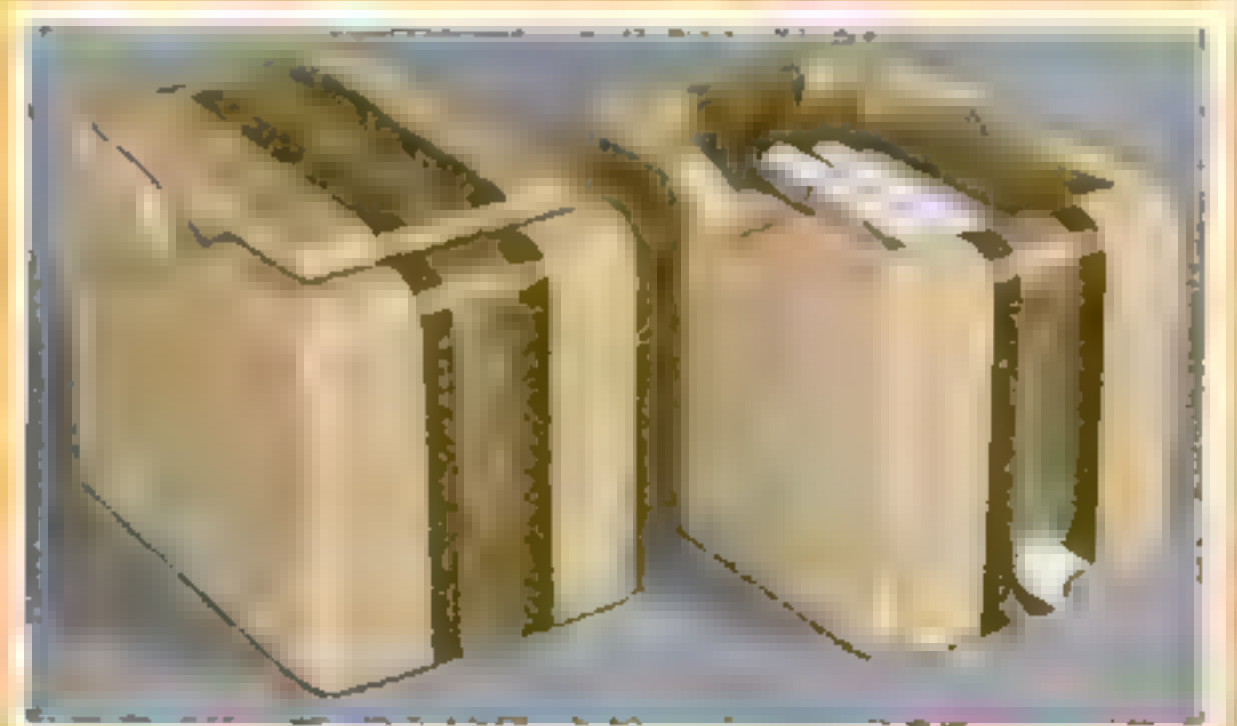
Sawing the glued-up block and, at left, a cross-section drawing showing the cuts. Below, parts after being drilled and cut



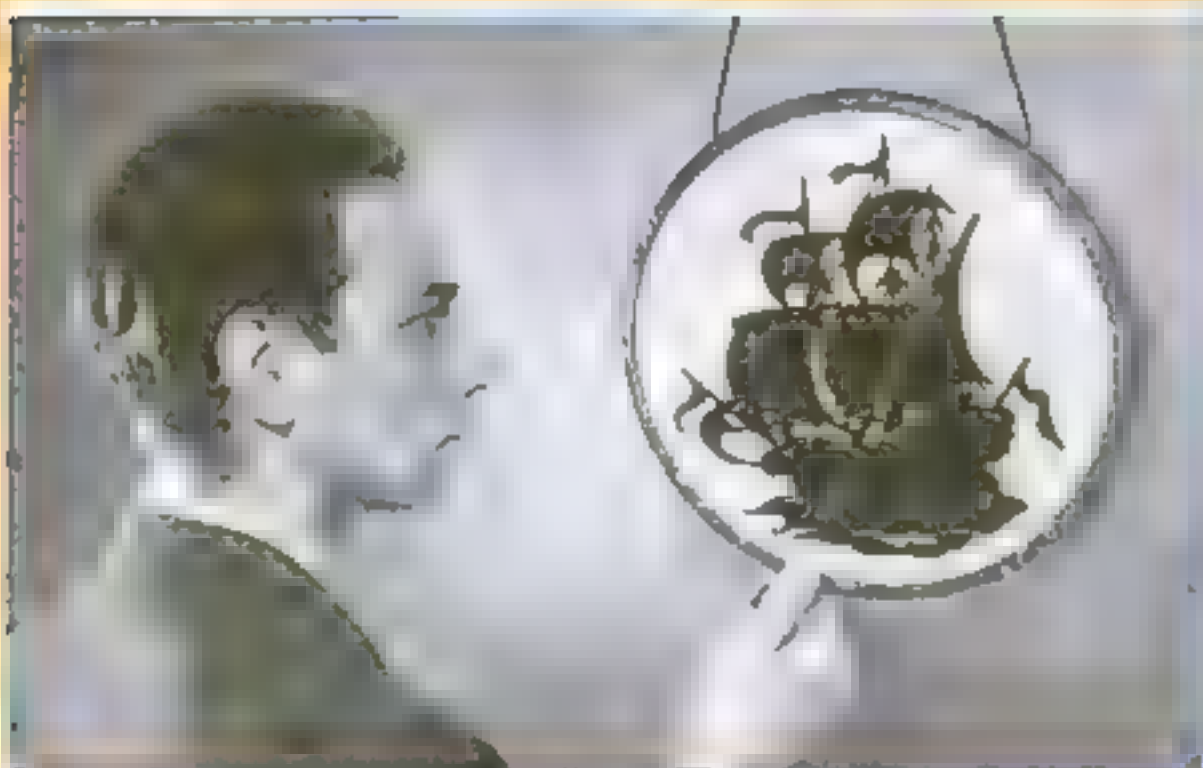
RED MAHOGANY
WALNUT



Gluing back the two end pieces. Left, an interior view to show how dispenser works



Jig-Sawed Galleon Decorates Bread-Board Plaque



The ship is cut from plywood, enameled black, and mounted on an ivory-colored baseboard



ONLY a small piece of plywood and a bread board purchased at a five-and-ten-cent store are needed for making a nautical wall plaque that adds to the attractiveness of any room. Enlarge the drawing, which appears near the end of the article, to full size and cut the ship from $\frac{3}{16}$ -in. thick three-ply basswood on the jig saw. Then glue the silhouette to the bread board, or to any baseboard you desire to use.

Enamel the ship black, the background ivory, and the rim red. Attach a (Continued on page 122)

NOVELTIES in Wood

Old Cowhan' Necktie Rack



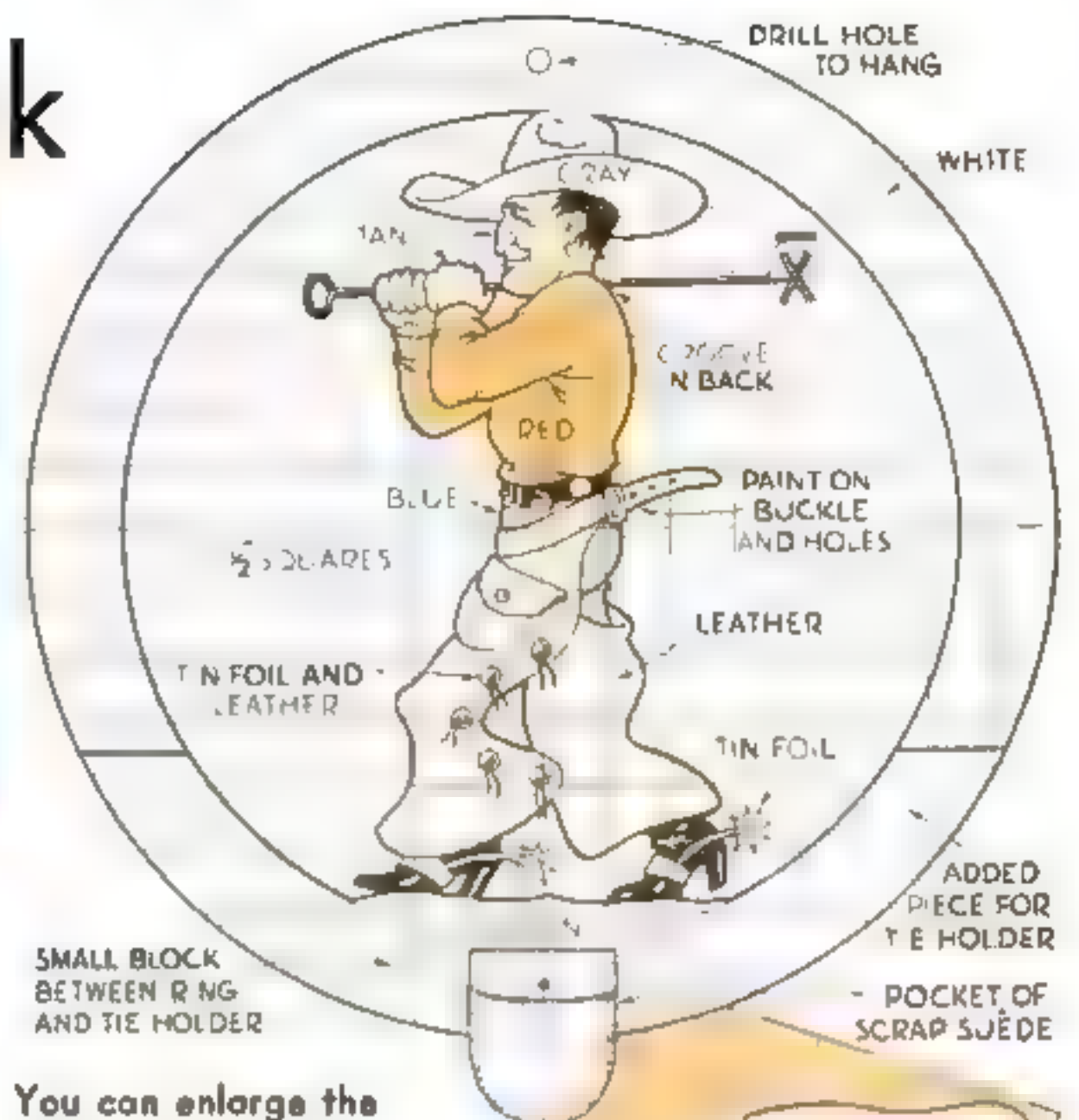
The rack holds ties and has a pocket for accessories. The photo above illustrates how the branding iron is set in a groove in back

which in turn are glued to the main frame. Sand all edges smooth.

The chaps are cut from an old leather jacket or any available leather and glued in place. If you have an old piece of hide with hair on it, such as rabbit fur, all the better. A small pocket is cut separately and glued on. The pocket to hold the tie clasp and collar grip is also cut out and glued in place later.

The conchas on the chaps are made from tin foil and glued along the edge of the outside leg. Bits of leather are glued to them. As a variation, a heart, club, diamond and spade may be cut and applied in the same manner. The rowels of the spurs are also made from tin foil.

His branding iron is made from No. 16 wire, bent to shape. As to the brand on the iron, you may use your own ideas. You may wish to use your own



You can enlarge the figure by first drawing $\frac{1}{2}$ -in. squares on paper, but use a compass for the circles



initials, a ranch brand, or Bar-X. A groove is cut in the back of the figure in which the iron is placed and glued.

The holder is painted in bright, gay colors, and suspended by a small hole drilled in the frame at the top as indicated.—RUDOLPH SHELTON.

LET this swaggering cowboy "ride herd" on your neckties, tie clasp, and collar grip. The old cowhan' will be just as much at home in a boy's room as in a guest room on a dude ranch.

First draw $\frac{1}{2}$ -in. squares on heavy paper and copy the figure. Then transfer the drawing to $\frac{1}{4}$ -in. plywood with carbon paper, mark the circles with a compass, and jig-saw out the spaces to be removed. The extra piece that forms the tie holder must also be cut. It is glued to two small blocks $\frac{1}{2}$ in. square,

Folding Stand Sawed from Scraps

THREE patterns are given in the accompanying drawings for a folding stand that can be jig-sawed from $\frac{1}{4}$ -in. plywood scraps or cut with a narrow band-saw blade. If the latter is used, all eight feet may be cut at once, the blanks being stacked together and held by a strip bradded to the straight edge.

All finishing should be done before the hinge is glued on. Then stack the legs together and run the straight, hinging edges over the jointer to expose the raw wood for gluing.

Clamp the legs together and glue on heavy duck or canvas, securing it at the corners with small tacks. The top holds the legs in place.—D. A. P.



The stand folded up and, at right, the drawings with three varied designs



The original stand was dipped in flat ivory paint before assembly, then antiqued and varnished. A transfer was applied to the top

We Add the Tender to Our LOCOMOTIVE MODEL

By
HAROLD V.
LOOSE

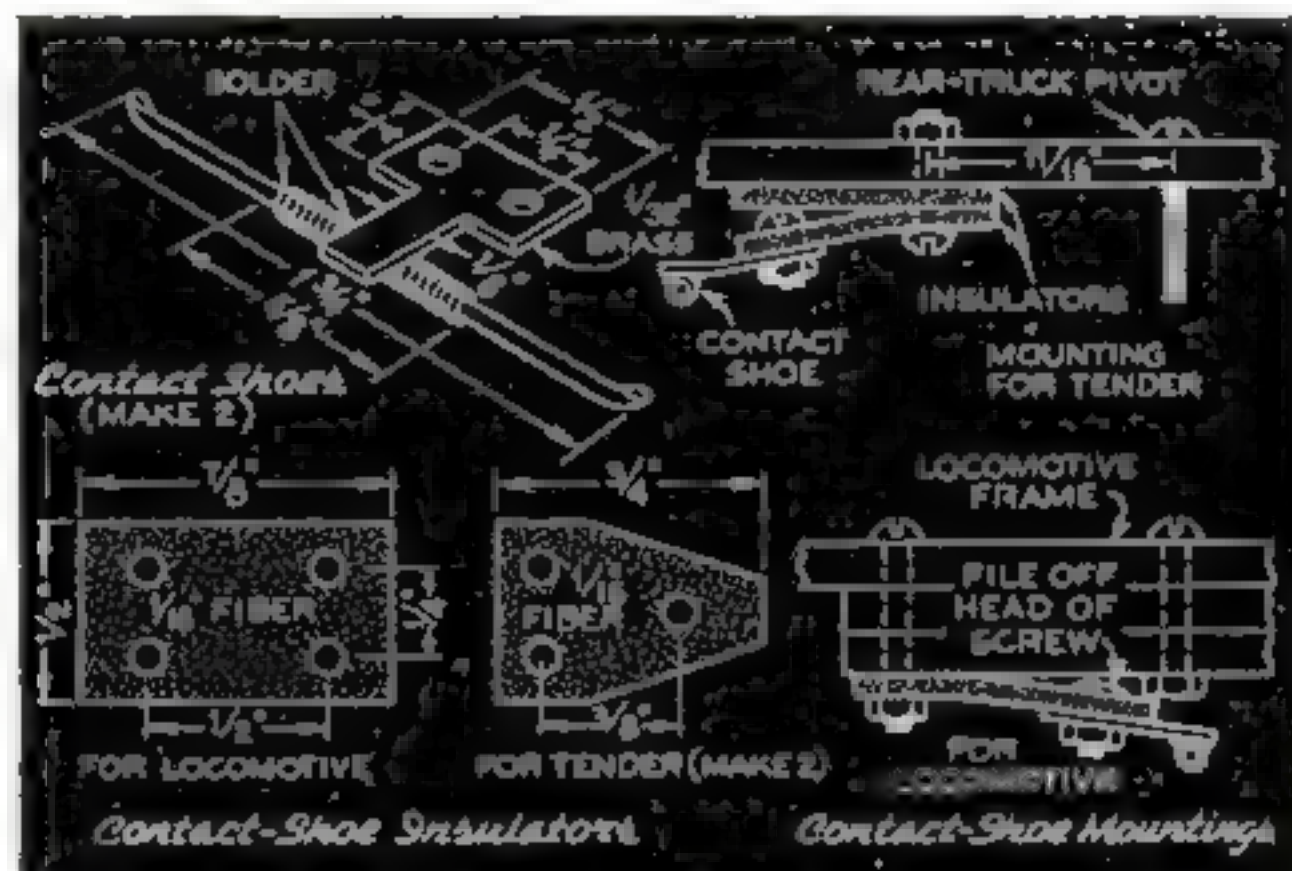


This small "loco" gives all the thrills of model railroading without the usual expense

ALTHOUGH it still lacks a tender, the HO-gauge locomotive model described in the two preceding articles in this series is almost ready to run. Most builders by this time will be anxious to see the model in action, so the next step is to mount the motor.

Make the motor bracket from 1/32-in. annealed brass as shown in one of the drawings that appeared last month (P.S.M., Dec. '37, p. 83) and attach it to the motor. Next fasten the worm on the shaft. The worm should fit tightly, but be careful not to damage the motor in pressing it on. If necessary, the shaft may be reduced slightly in diameter with a fine file while the motor is running. In some cases the worm, as purchased, may be provided with a set screw; ordinarily, however, a hole will have to be drilled and the worm pinned to the shaft.

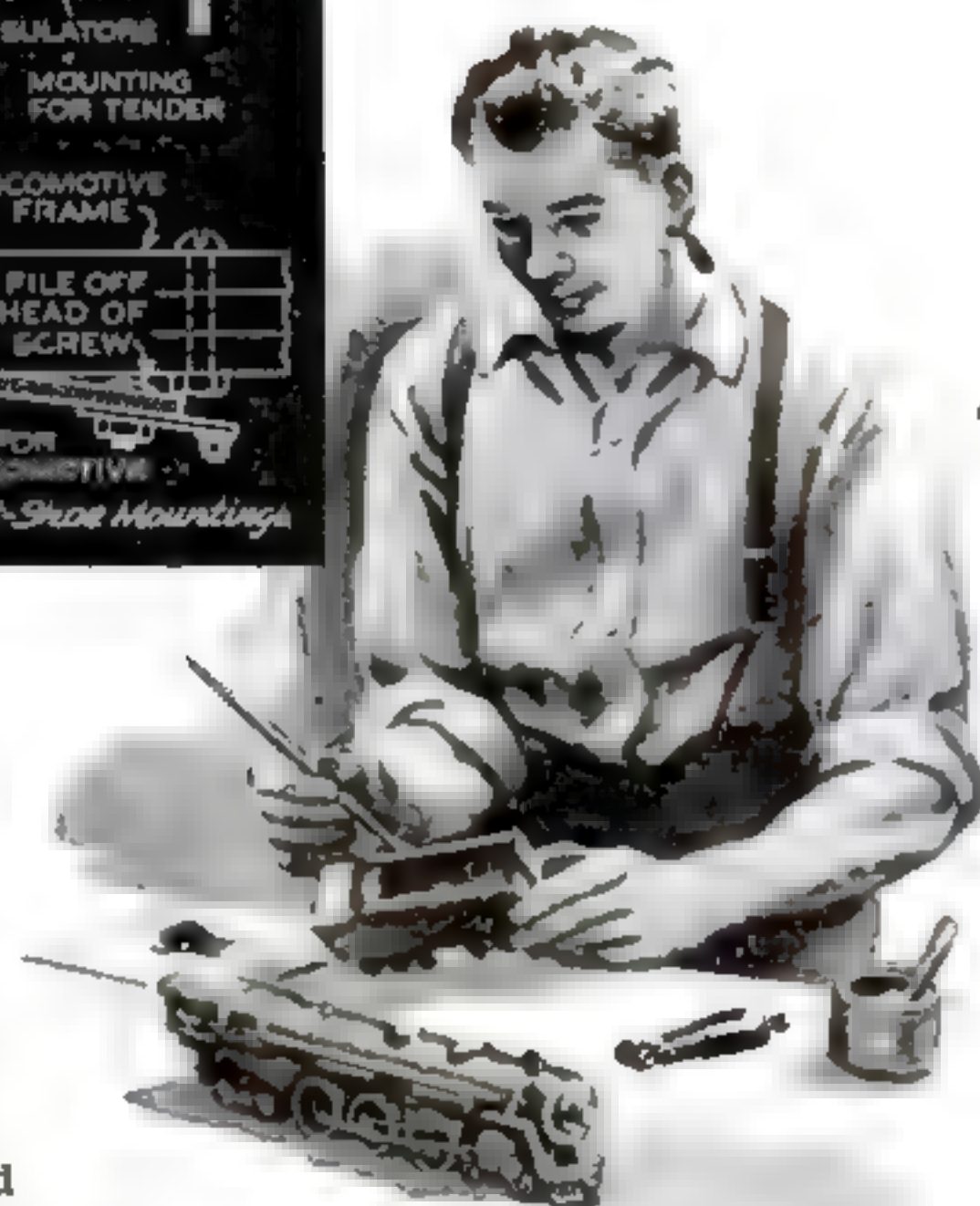
Once the worm is on the shaft, bend the lower end of the bracket so that, when bolted to the rear pair of holes in the frame, it will bring the worm and worm gear into correct alignment. It is important to get this just right, so take your time with this job. If the gears do not mesh properly, they will not only waste power, but will wear rapidly.



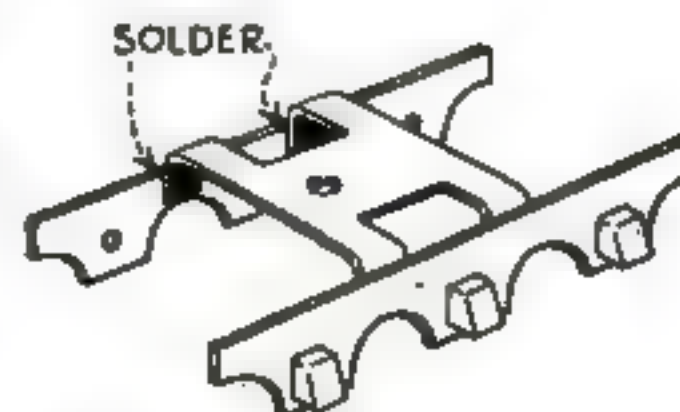
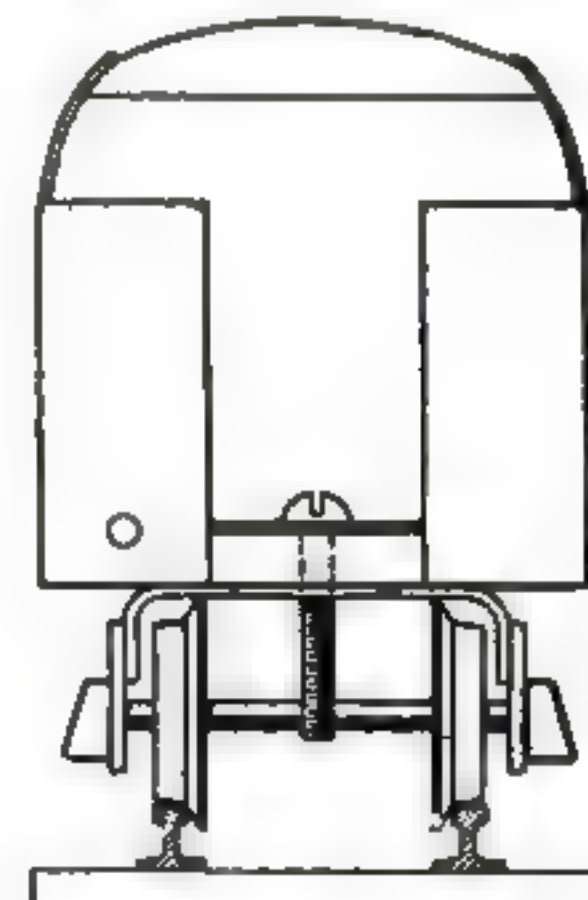
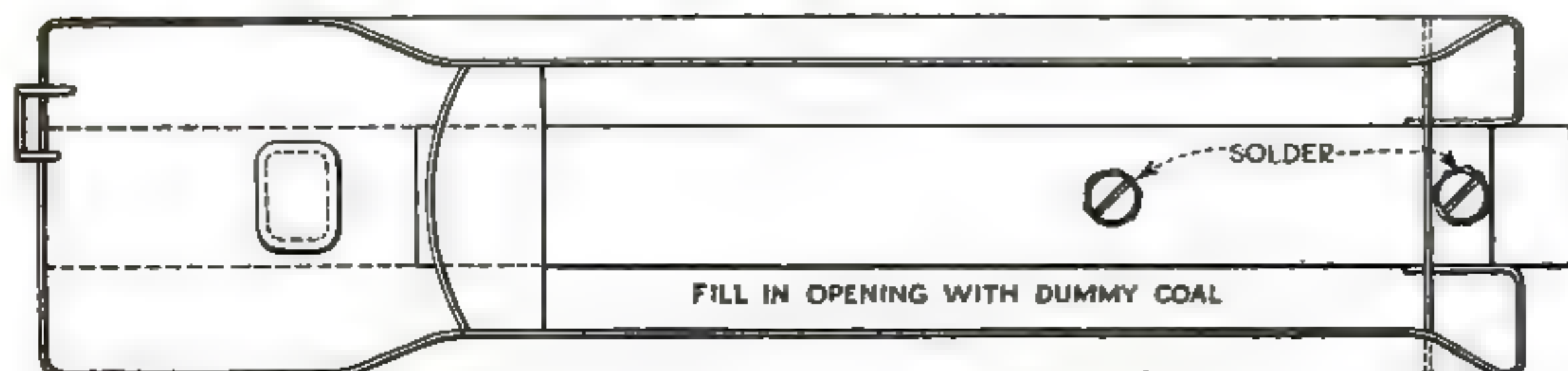
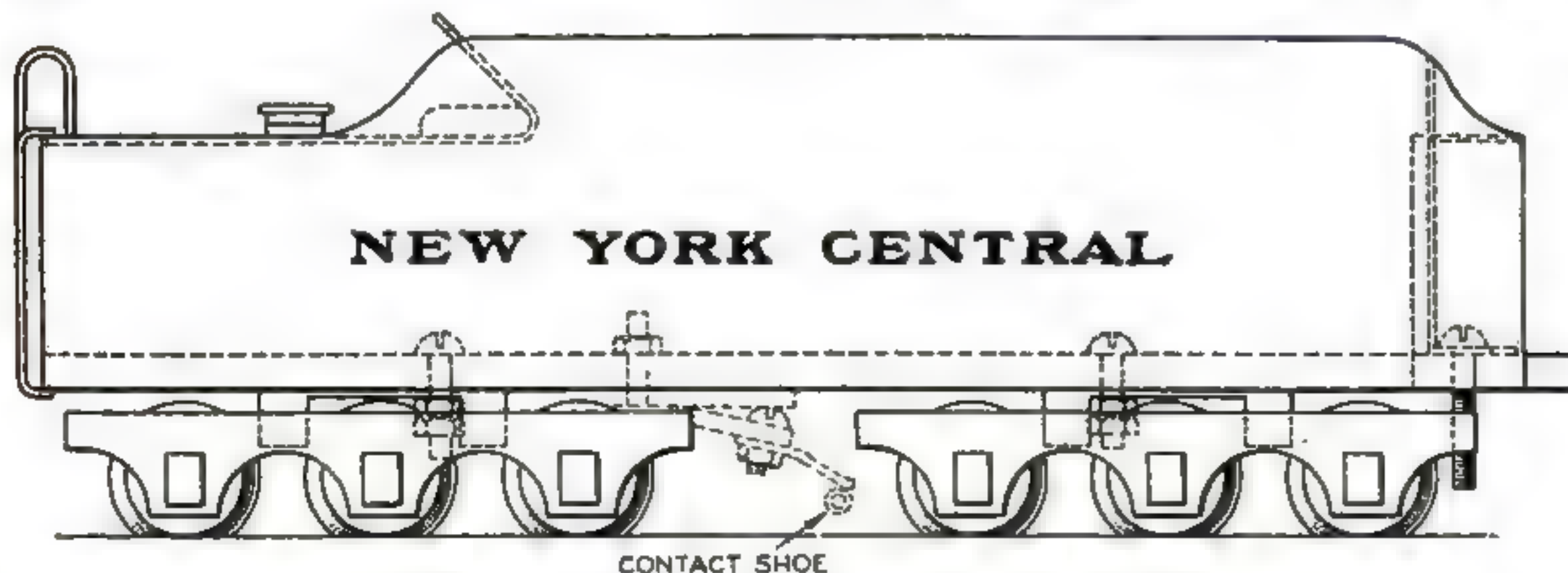
The contact shoes used on locomotive and tender are made as shown at the left

Through the hole in the top of the motor bracket, solder a 2-56 screw so that when the bracket is bent forward, the bolt points upward and fits in the hole drilled in the boiler where it meets the fire box. To hold down this end of the locomotive, a 2-56 nut is altered to make it look like a set of safety valves. A small hole is drilled in every other face of the nut, and short bits of wire are soldered in place. When the locomotive is assembled, this screws down over the vertical bolt on the motor bracket.

The contact *(Continued on page 112)*



Painting must be carefully done, especially the white letters on the tender. The three views of the tender below are actual size



Detail of Truck Chassis

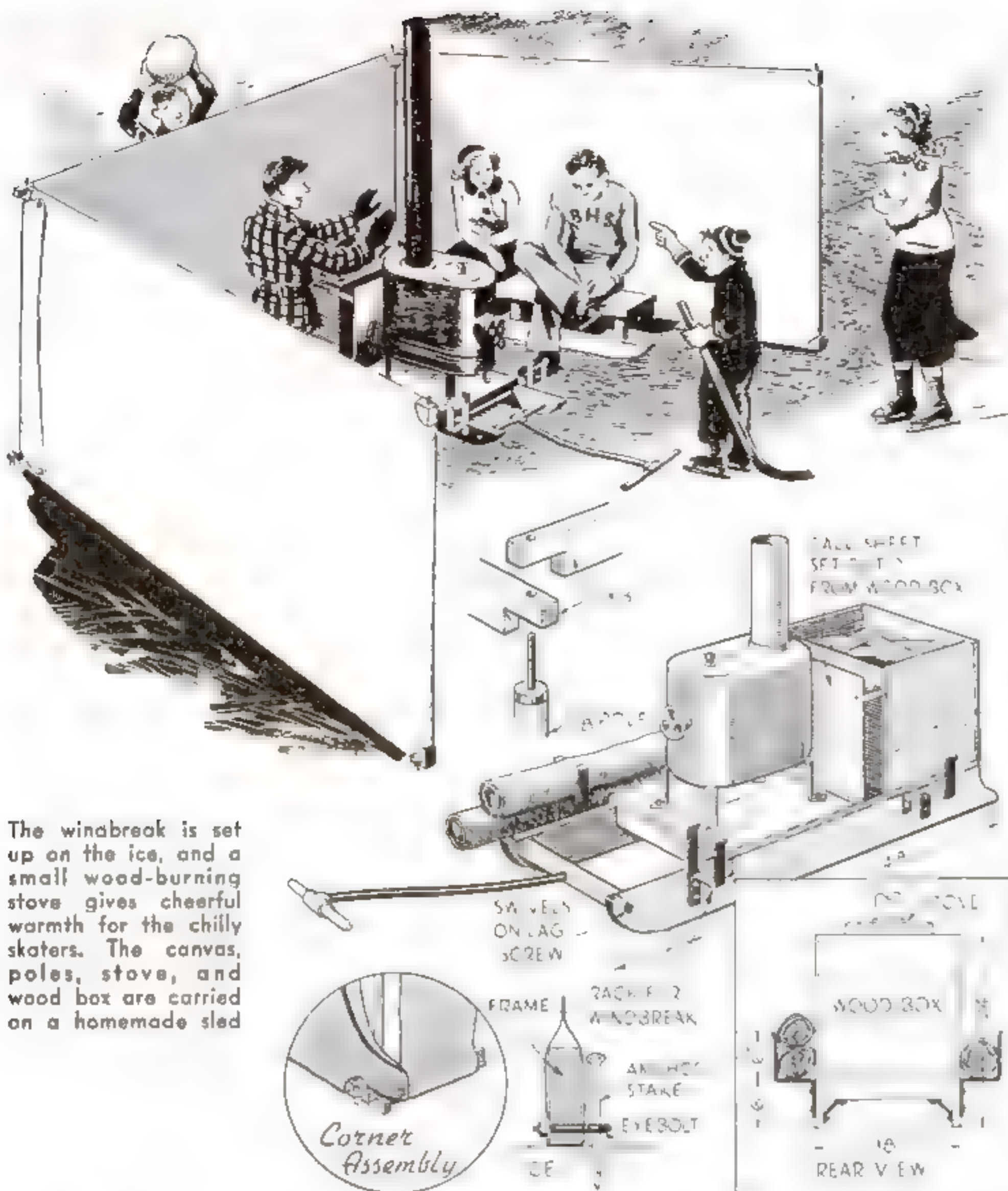
Automatic Target Uses Candy for Bullseyes

CANDY wafers are used to test the skill of rifle and pistol shooters in this unusual target, which was devised by Frank Seywert for use on the shooting range of a Cleveland, Ohio, hardware store. It is made from a piece of $\frac{1}{4}$ -in. steel plate near the bottom of which a 1-in. hole is drilled. On the back is a slot chamber made up of two steel strips, $\frac{1}{16}$ in. thick and $\frac{1}{2}$ in. wide, set 1 in. apart and covered by a piece of sheet metal. The assembly is fastened by means of machine screws, which pass through holes drilled in the sheet metal and steel strips and are set into tapped holes in the main plate. Another screw is fixed in the back of the main plate, just under the hole, to stop wafers at the peephole location.

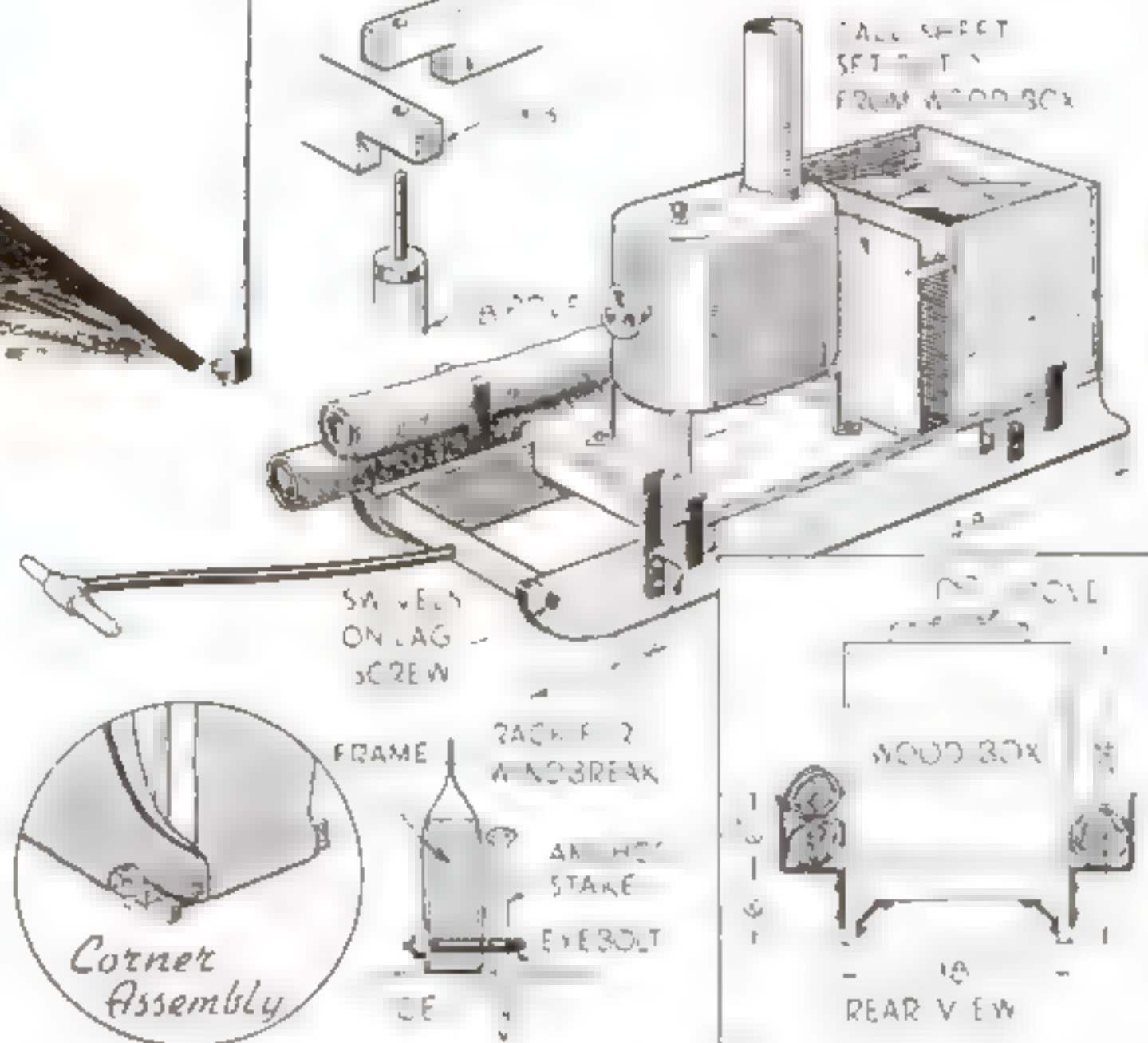
The candy wafers are dropped into the top of the slot chamber, which is long enough to hold a good supply. As one of the wafers is shot out of the bullseye, another feeds down to take its place, and the shooting may proceed without interruption until a new supply is needed.—WILSON B. FISKE.



Filling the slot with candy wafers, which slide down to serve as breakable bullseyes



The windbreak is set up on the ice, and a small wood-burning stove gives cheerful warmth for the chilly skaters. The canvas, poles, stove, and wood box are carried on a homemade sled



A Snug Harbor for Skaters

BY MEANS of a folding windbreak of canvas and an inexpensive sheet-iron stove mounted on a sled, an inviting haven for skaters can be erected at little expense. It will be welcomed by skaters after an hour or two on a wind-swept pond, especially if located right on the ice where there will be no damage to sharp skate runners, as might be the case in walking up on shore.

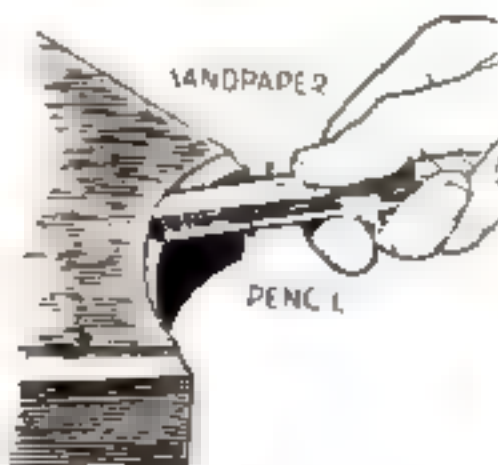
The entire equipment can be hauled to its destination on a comparatively small sled of simple construction. Runners are of 1 by 6-in. pine shod with strap iron and having strap-iron brack-

ets on the sides to carry the rolled-up windbreak. Stove legs are bolted to the sled top, and a wood box is mounted behind. A sheet-metal screen is installed between stove and wood box, as shown.

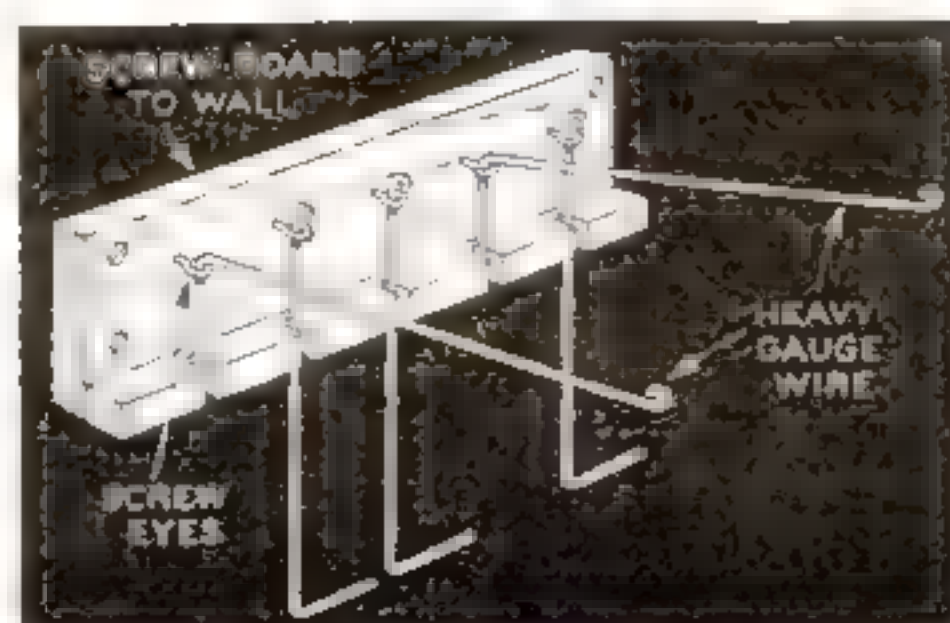
The windbreak is made in three sections, each 4 ft. high and 7 ft. long, and is designed to be taken apart and rolled up in its own sheet of canvas. The frame members slip into wide hems, and the middle section has flaps at the ends to lap over the adjoining section so there will be no icy draft whistling through. The frames are anchored by an iron stake in an eyebolt.—H. S.

Sandpapering the Finish in Small Grooves

IN FINISHING woodwork that has already received one or more coats, it is a problem to sand any grooves of small radius. An excellent method is to use the eraser end of a pencil, shaped with sandpaper to fit the groove. A narrow strip of very fine sandpaper is held over the pencil as shown.—CORNELIUS BADIK.



Towel Rack Has Folding Wire Arms



The rack with two arms in raised position

TO CONSTRUCT the collapsible towel rack shown, the only materials necessary are two scrap pieces of board, several screw eyes and screws, and a few lengths of heavy gauge wire. The rack may be made any convenient size. Painted or varnished to match the woodwork of the kitchen, this little accessory will prove acceptable for drying dish towels and other articles. If iron wire and screw eyes are used, they should be finished with several coats of high-grade enamel to prevent the metal from rusting.—G. E. H.

Hub Cap Serves as Ladle for Sulphur

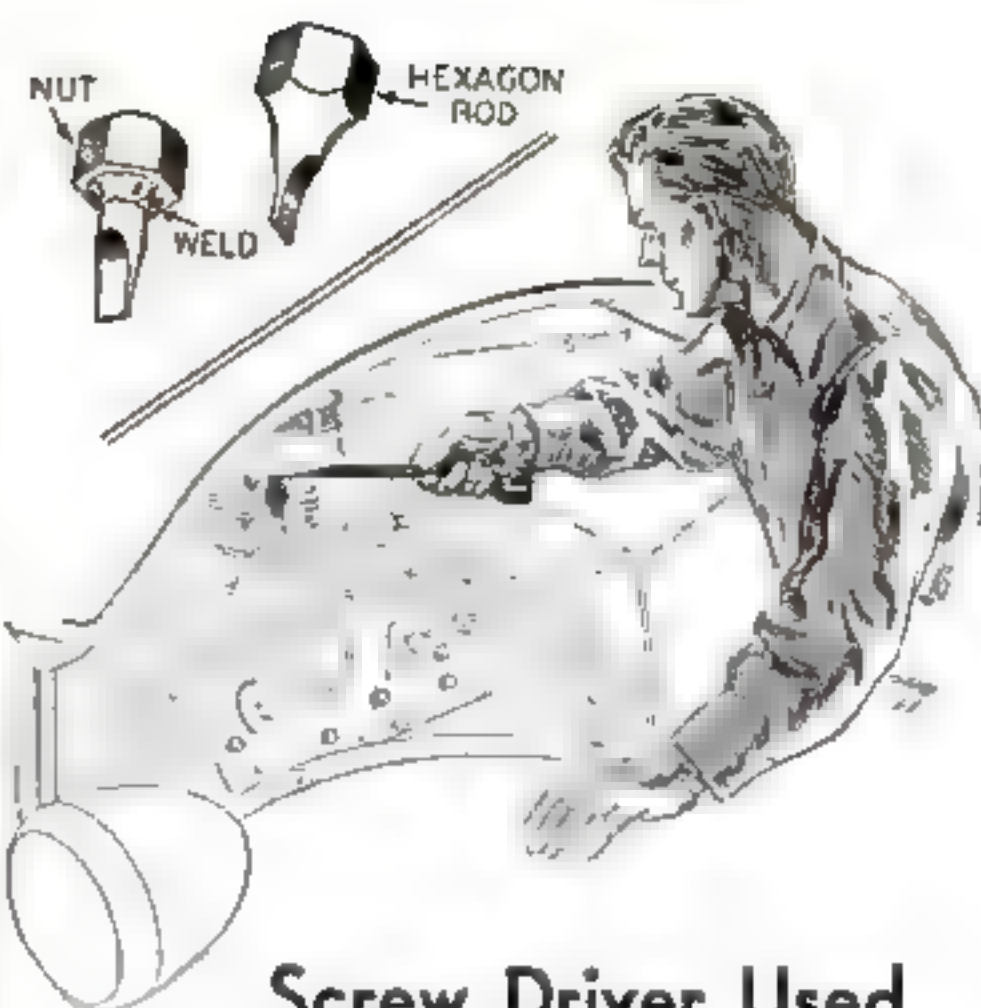


After the bolts had been set into holes in the concrete, molten sulphur was poured around them from the hub cap

UNLESS bolts can be embedded in concrete at the time it is poured, the problem of fastening sills, sleepers, frames, or other wooden parts to the masonry is often a troublesome one. Not only do holes have to be drilled, but either expensive bolts of one of the expansion varieties have to be used, or some method must be devised to secure plain bolts in the holes.

An ingenious solution was worked out in constructing a bowling alley, where an old concrete floor had to be covered with one of wood. In place of expansion bolts, ordinary ones were used. They were anchored in the holes with molten sulphur, heated in an automobile hub cap to which a handle had been attached, as shown. A hole drilled in the rim served as a pouring vent.

So securely were the bolts held that several misplaced ones could not be removed, but had to be broken off flush with the concrete floor. —KENNETH MURRAY.

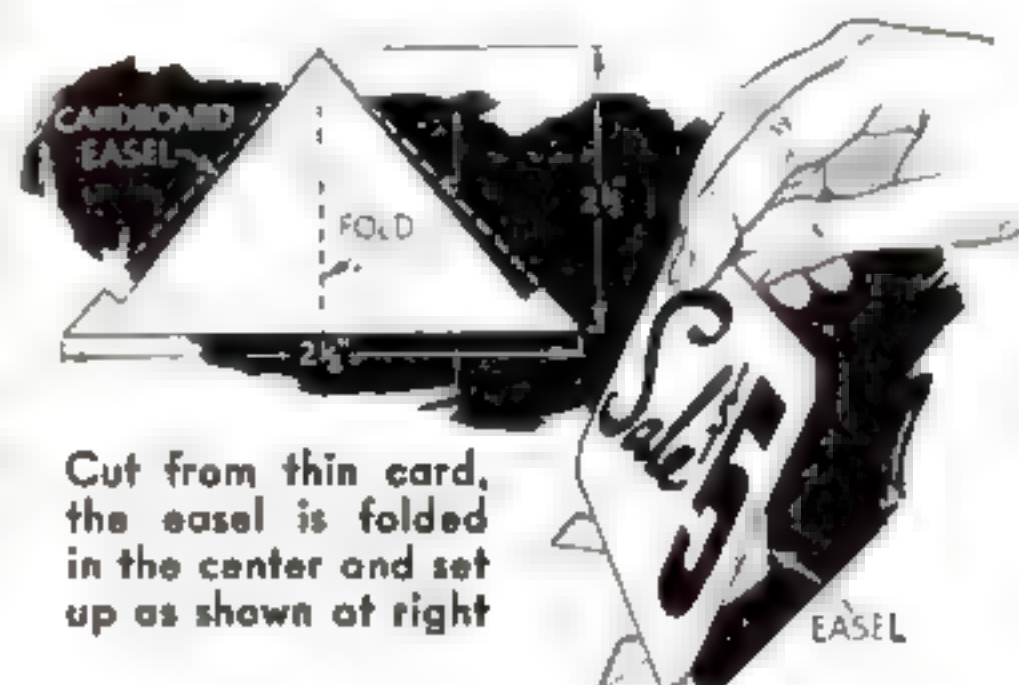


Screw Driver Used with Socket-Wrench Kit

BY ADDING this screw-driver attachment to your socket-wrench kit, you will have a powerful tool for turning screws in awkward places. The screw driver may be made from tool steel, or a small piece of tool steel may be welded to a hexagon nut. Harden and temper the tool.—B.K.

One-Piece Cardboard Easel Holds Price Ticket

IT TAKES but a moment to make an easel of the type shown below for displaying price tickets on the counter or in a window. It can also be used for holding greeting cards, photographs, and even small packages of merchandise. A sheet of thin card is merely folded in half and cut as indicated with a razor blade, sharp knife, or scissors. The easel is then opened at an angle of about 45 deg.—H. R. WALLIN.

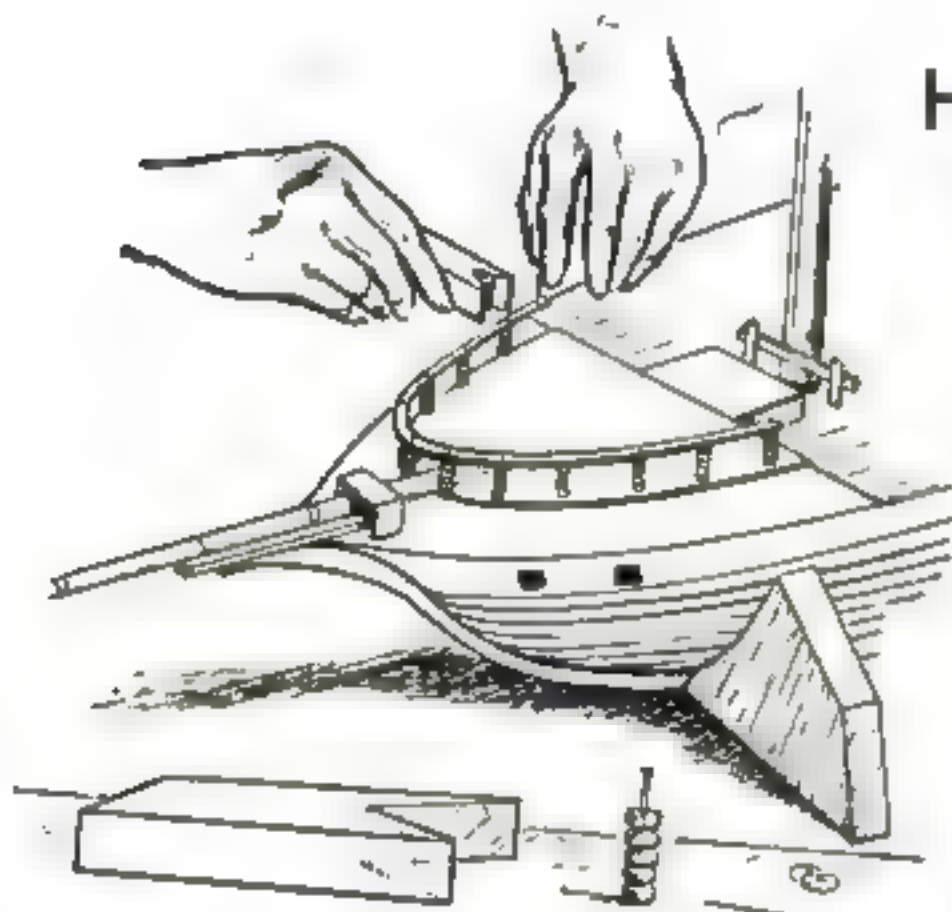


Cut from thin card, the easel is folded in the center and set up as shown at right

How to Set Beads in Position for Ship-Model Stanchions

WHEN beads are used for ship-model stanchions, they can be set in place with a notched softwood holder as at the left. Place the required number of beads on a pin, stick the point in a board, and push the holder against the beads until they are wedged in the notch. The pin then can be withdrawn, the beads located properly under the rail, and the pin pushed through the rail and the beads.

Remove the holder, cut off the head of the pin, and tap the pin into the deck until the top is flush with the rail. Then assemble the beads for the next stanchion.—BILL COWAN, JR.



The holder, made of softwood, should be just high enough to slide under the rail

Depth Gauge for Carved Backgrounds

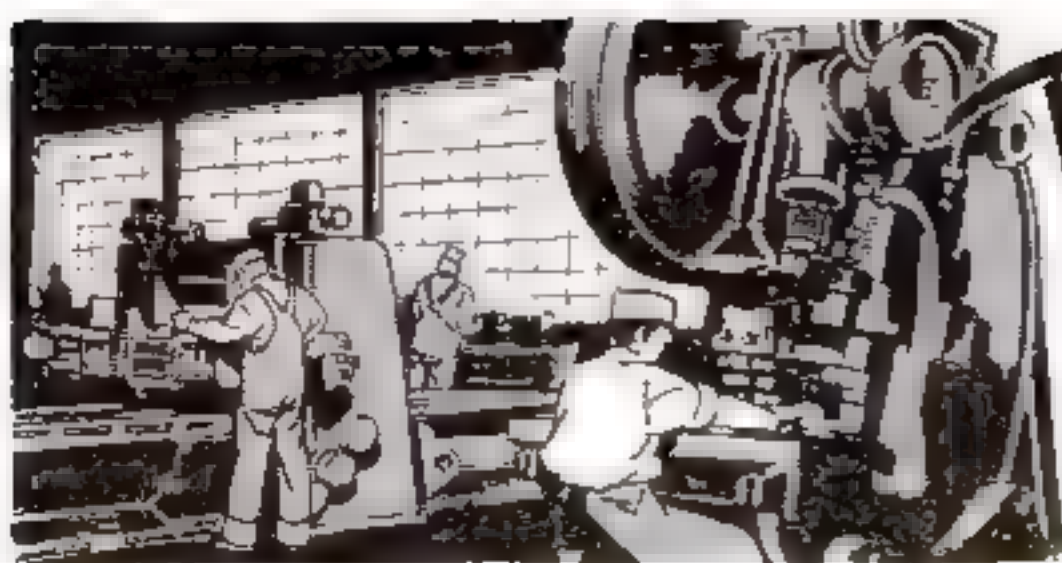
A WOOD carver's depth gauge, useful for cutting backgrounds to a uniform depth, may be made as in the photograph below, which shows the bottom view of one gauge and the parts of another. A 3/16-in. hole is bored through the center of a 1 by 2 by 4-in. hardwood block. A 1/4 by 2 1/2 in. by 20-thread wing bolt is ground to a flat edge as shown and threaded into the hole. A wing nut locks it at any desired depth.—JOHN STEWART WILCOX.



The gauge is made as at the left and used in testing backgrounds as illustrated above

Soldering Iron Presses Ties

AFTER neckties become wrinkled, they may quickly be pressed by employing an electric soldering iron over which a copper or brass tube has been slipped to serve as a roller. Dampen the ties with a sponge or wet cloth before starting to press them.—WELLINGTON KIRK.



Better SHOP Methods

HOW MACHINE SHOPS CAN CUT THE COST OF Piercing Punches and Dies

By HECTOR J. CHAMBERLAND

GOOD results in punch-press work depend upon the precision of the finished punch and die members and the condition of the press.

From the point of view of capacity, the average punch press is like an automotive truck—often the victim of an overload. This is especially true in the small shop. Too small a punch press or one mechanically troubled with misalignment has caused the scrapping of many a costly punch and die set.

While our interest is chiefly in producing an accurate and economical punch and die, we cannot get anywhere unless we are positive that the punch press is suitable in respect to condition and capacity. Punch presses are made with single or double cranks. The capacity of a double-crank press usually starts to increase only with a 10-in. diameter crankshaft, and even at this point it will show an increase of only ten tons over the single-crank press. However, an 18-in. shaft increases the capacity of the double-crank press by 140 tons. These figures are, of course, computed at the bottom of the stroke.

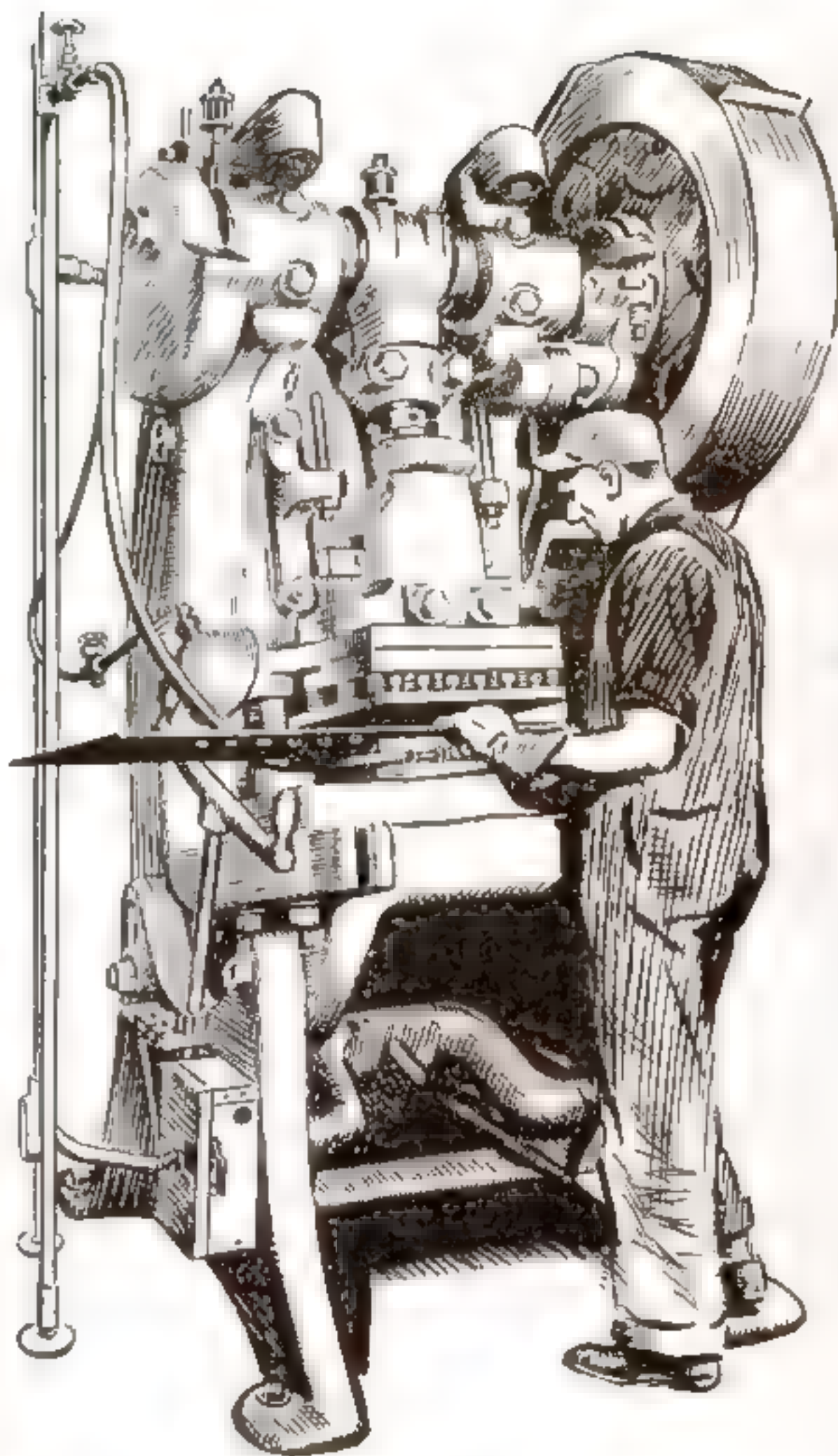
Bear in mind also that it requires a pressure of 19,500 lb. to punch a 1-in. diameter hole in $\frac{1}{8}$ -in. washer stock, 29,000 lb. in carbon steel, and 13,500 lb. in brass. The pressure required increases 10,000, 15,000 and 7,000 lb. respectively with every $\frac{1}{16}$ in.

Assuming that the press is capable of handling the job and its chief com-

ponents are in nearly perfect, if not perfect, alignment, we can start work on the punch and die.

The first step is to select the proper die set, that is, the punch holder and die shoe. It doesn't pay a machine shop to make these parts—any more than it does to make files or hacksaw blades. Punch and die sets are now available in sizes from 3 to 28 in. between centers of leader pins and in approximately fifty styles. Three types especially adaptable to the small shop are shown in Figs. 1, 2, and 3.

Figure 1 is a design that is extensively used. It has a substantial working surface due to the fact that the leader pins are located

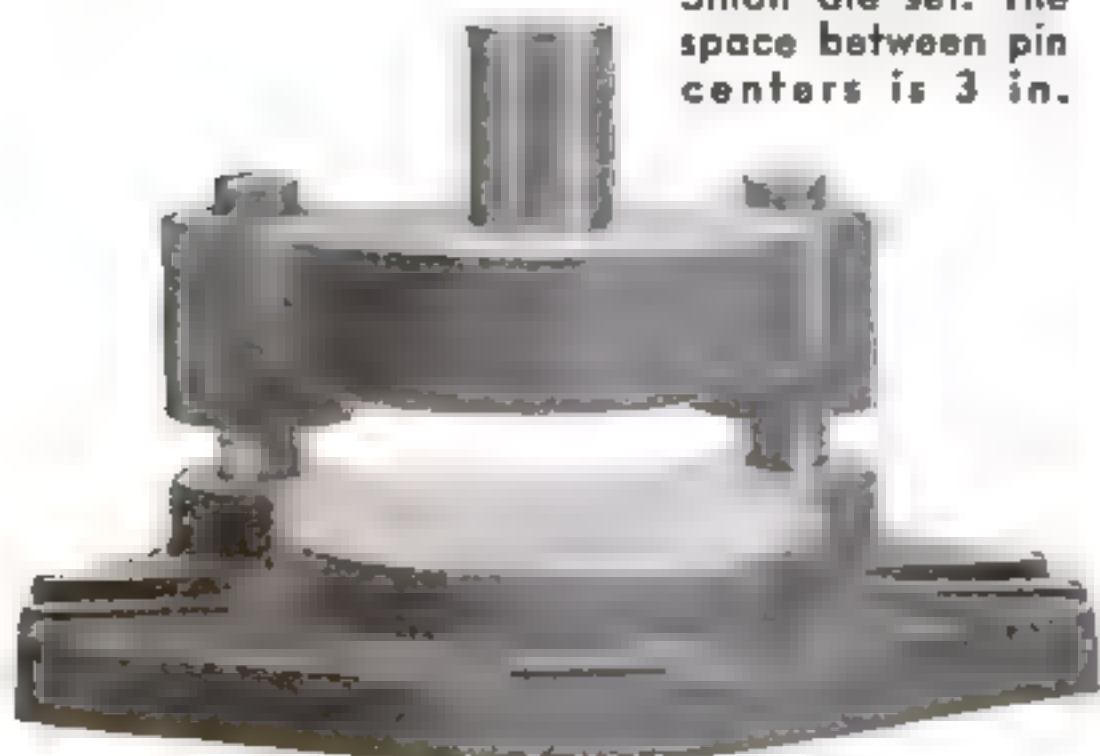


far apart and at the rear. Two-leader-pin sets are recommended for light and medium work. These can be obtained in sizes from 3 to 14 in. between centers of leader pins.

The four-pin design in Fig. 2 is, of course, intended for heavy work. Sets of this type are available from stock in sizes from 13 to 28 in. between centers of leader pins.

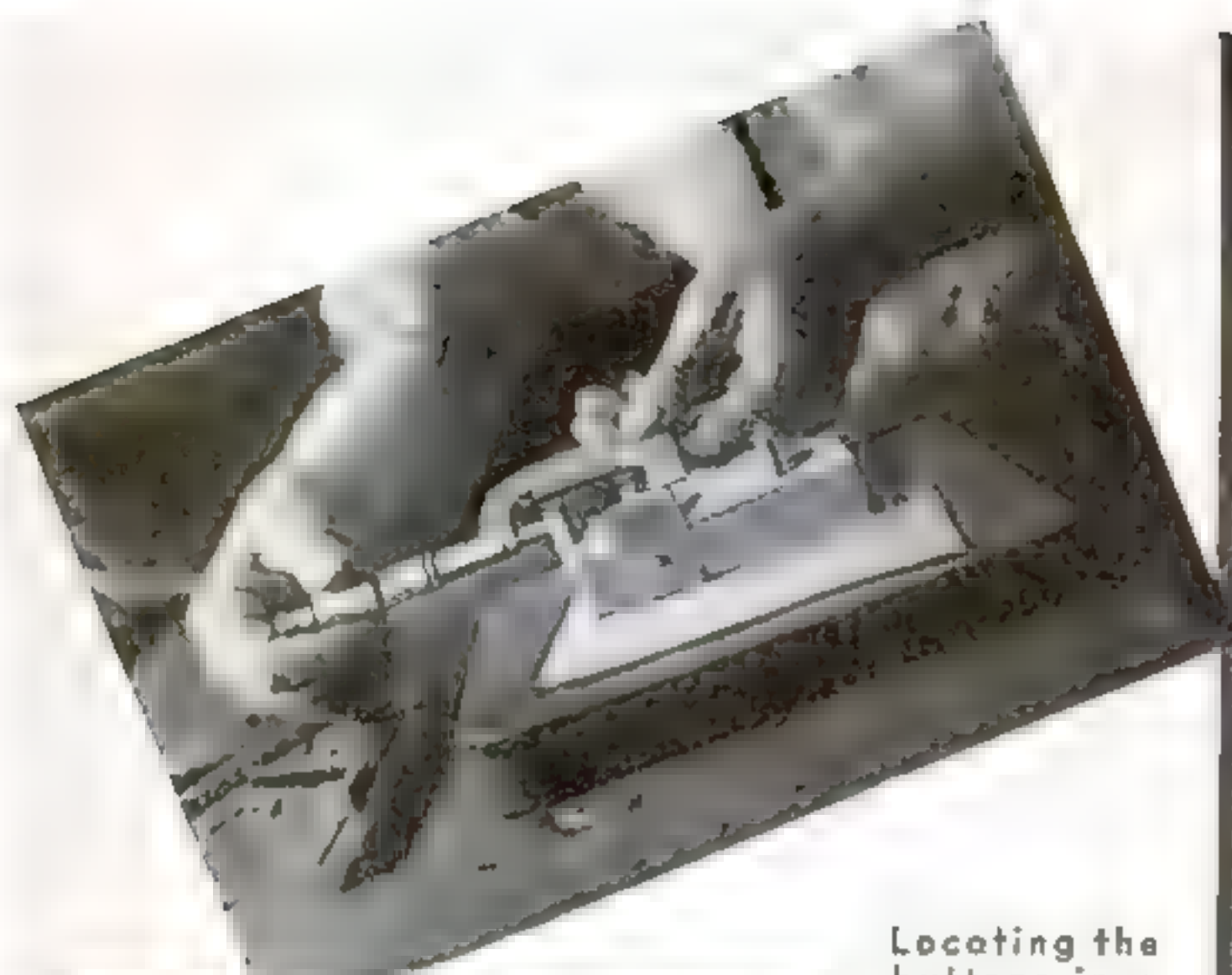
Figure 3 is the so-called "floating swivel" style, which makes it possible to relieve strains on the die due to inaccuracies of the press. The die set is not intended to make a misaligned press perform like a new one, but if it is not possible to make extensive repairs when required, this arrangement goes a long way toward insuring satisfactory results.

There are times, due to some unexpected rush job, when it would cause too much delay to wait for the delivery of a manufactured

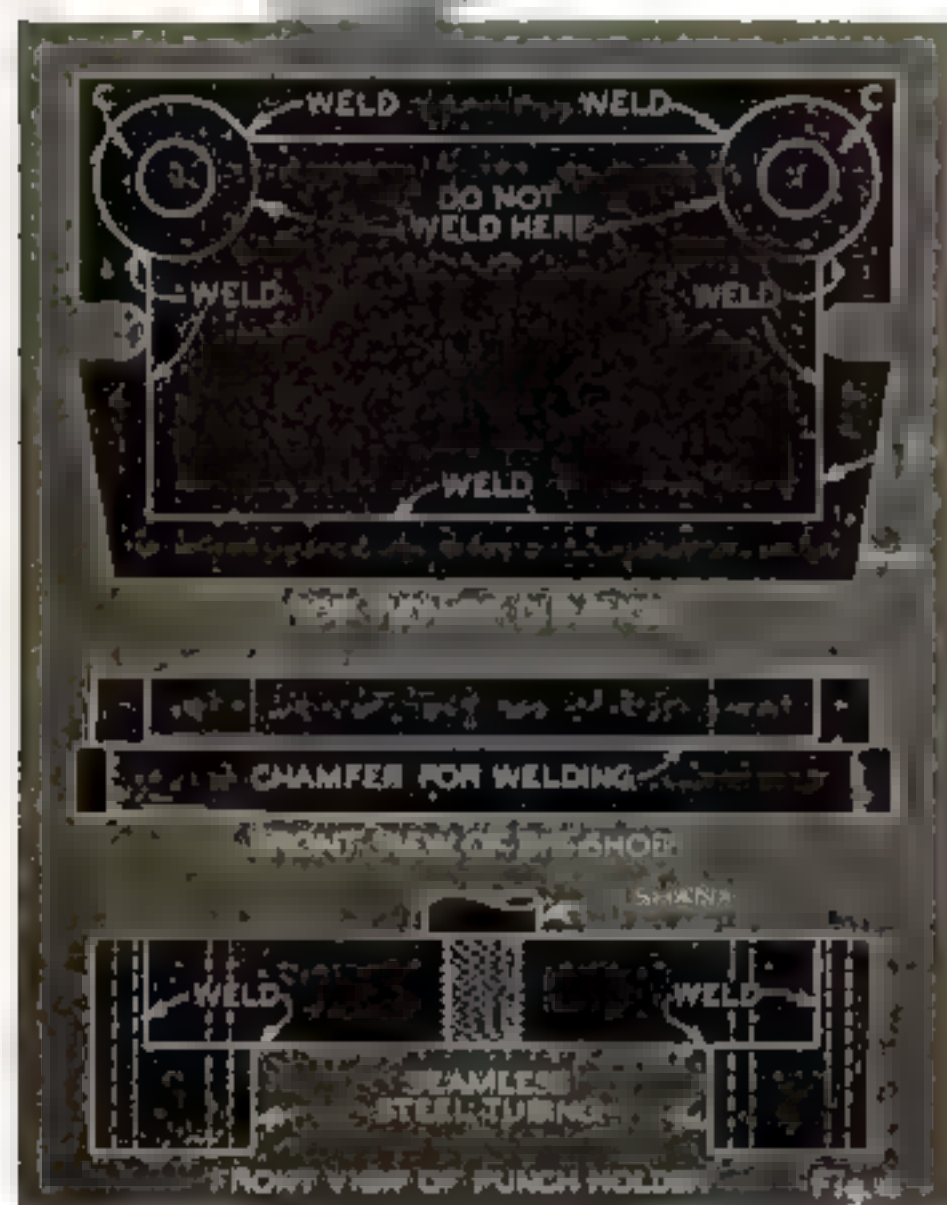


Small die set. The space between pin centers is 3 in.





Locating the buttons in a punch and die set. Left, a welded design. Right, floating swivel die set



die set. In this case a very good die set can be made quickly of welded steel construction as shown in Fig. 4. Note that very little machining is required. The die shoe is made by welding plate B to plate A. Contours are milled on the rear corners of B to weld the two parts C, which are nothing more than pieces of seamless steel tubing of the same height as B.

The punch holder is a duplicate of plate B with CC welded to it, except that the plate used should be about three quarters the total thickness of A and B of the die shoe. The same tubing is used for the punch holder, but the pieces are as long as twice the thickness



of the plate. Gold-rolled steel would answer the purpose, but tubing saves drilling; however, plate A must be drilled before aligning the two welded parts and strapping them together to bore the holes to the diameter of the leader pins. The bearings of the punch holder may then be rebored for the bearing bushings.

What about the strength and rigidity of a welded job of this nature? You needn't worry about that at all because a 3,000-lb. die was recently made by welding; it punches 1-in. square holes in $\frac{1}{2}$ -in. stock and stands a load of 350 tons.

Many small plants have recently been modernized, more or less, and piercing punch and die work is no problem where equipment of the vernier type is available. On the other hand, boring in the

lathe and with a vertical attachment in the milling machine will be done in small shops for some time to come. As this class of work requires punches and die bushings to be fitted into soft steel plates, it is obvious that the plates must be identical in respect to the spacing of the various holes. Of course, all holes need not be precisely the same diameter; this is taken care of when fitting either bushings or punches.

The lathe can be trusted for boring plates not over 7 by 8 in. and with less than eight holes, but the spindle bearings must be perfect. The faceplate should also be surfaced lightly to correct any lateral error, (*Continued on page 128*)

Curved Auxiliary Vise Jaws Made from Old Field Poles of Motor

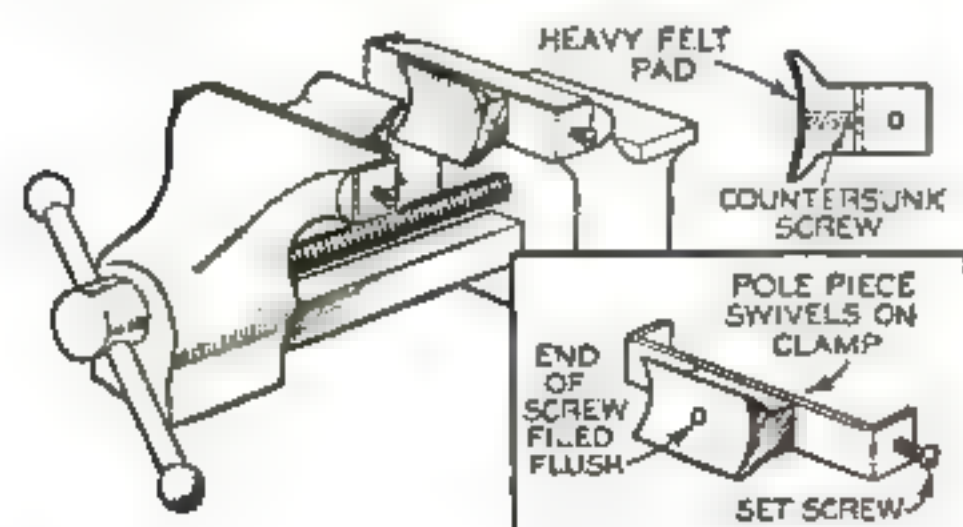
CURVED and swiveling auxiliary jaws to hold small armatures and other round pieces in the bench vise can be quickly made from a couple of pole pieces taken from a discarded auto generator or motor field frame and a length of $\frac{3}{8}$ -in. strap iron. Cut the strap, which may be made from $\frac{3}{4}$ to $1\frac{1}{4}$ in. wide, into two lengths, each 2 in. longer than the width of the vise jaws, and bend the ends at right angles as shown.

Drill and tap a hole for a $\frac{3}{16}$ -in. set screw in one side of each piece; also drill a hole through the center of each clamp of such a size that the original screw of the pole piece makes a close



but turning fit in it. Countersink these holes on the inside, then attach the pole pieces and grind off any part of the screw ends protruding from the concave face. Glue or cement pieces of heavy felt or rubber over the curved faces to protect the work from any injury.

Although designed especially for clamping armatures without injuring the windings or laminated cores, this jig is adapted for holding any cylindrical article within its capacity. Because of the swiveling feature, the jig can hold work at any angle.—W. C. W.



Wire Holds Chuck Key on Electric Drill

AGGRAVATED by having to search through the tool box for the key to the chuck of his electric drill, a mechanic remedied the difficulty by making a small clip out of spring brass wire and fastening it under one of the screws on the front of the drill. Here it does not interfere with the normal use of the drill and is always ready for service without loss of time or temper.—W. W.

Pie Trimmer Cleans Up Putty

A TEN-CENT pie trimmer, obtainable at department stores, can be used for cleaning up putty jobs when installing window glass.—E. A. BOWER.

Spacing Holes in Indexing Head

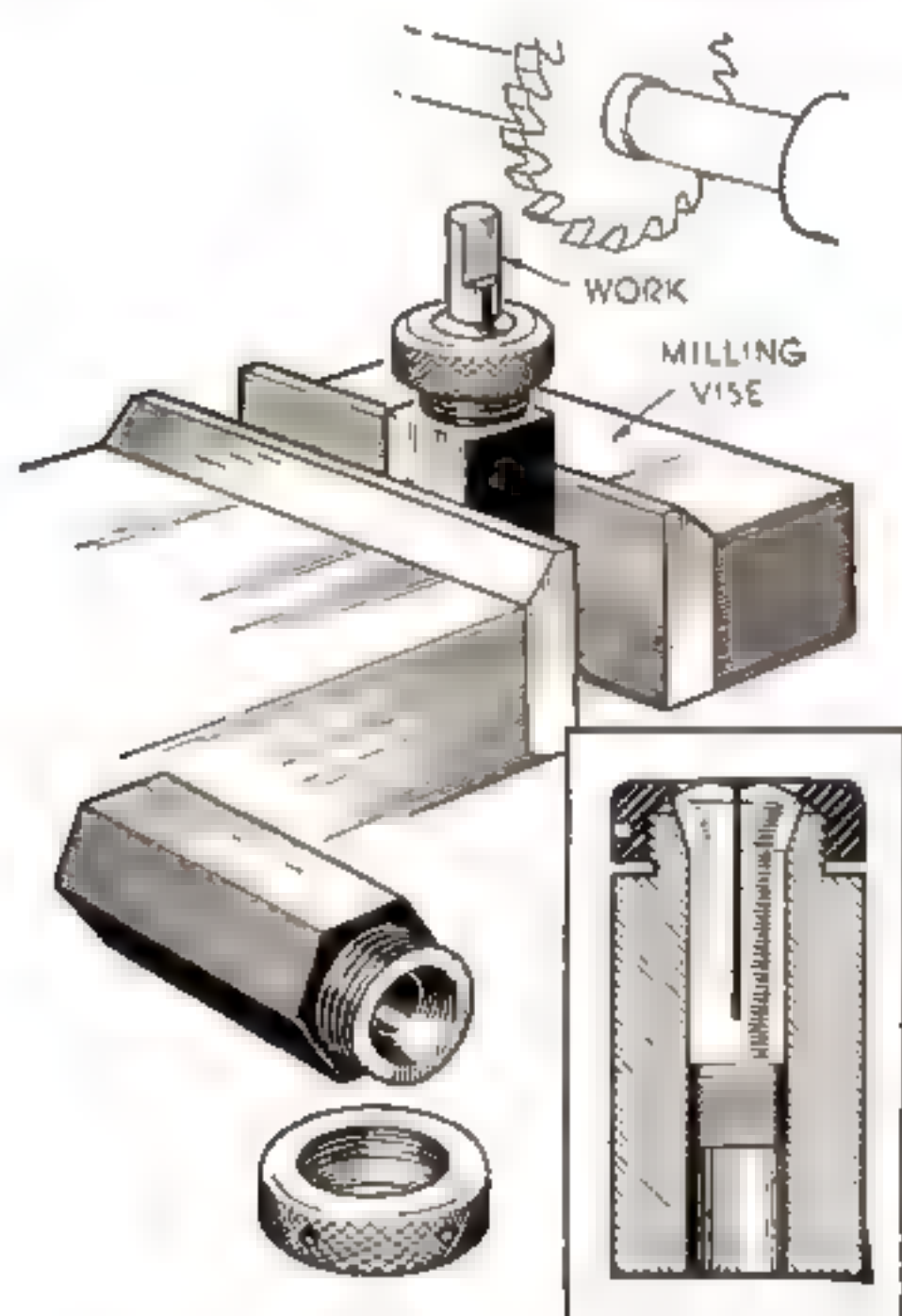
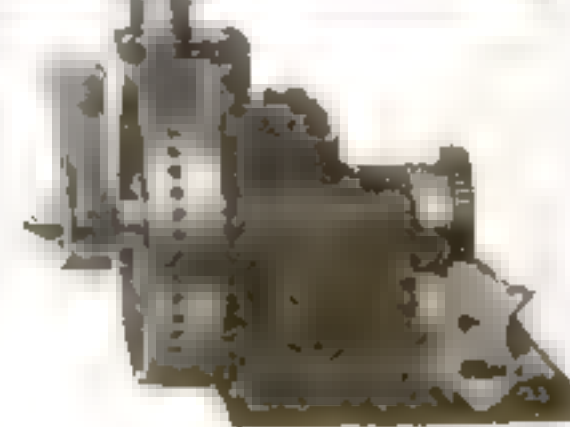
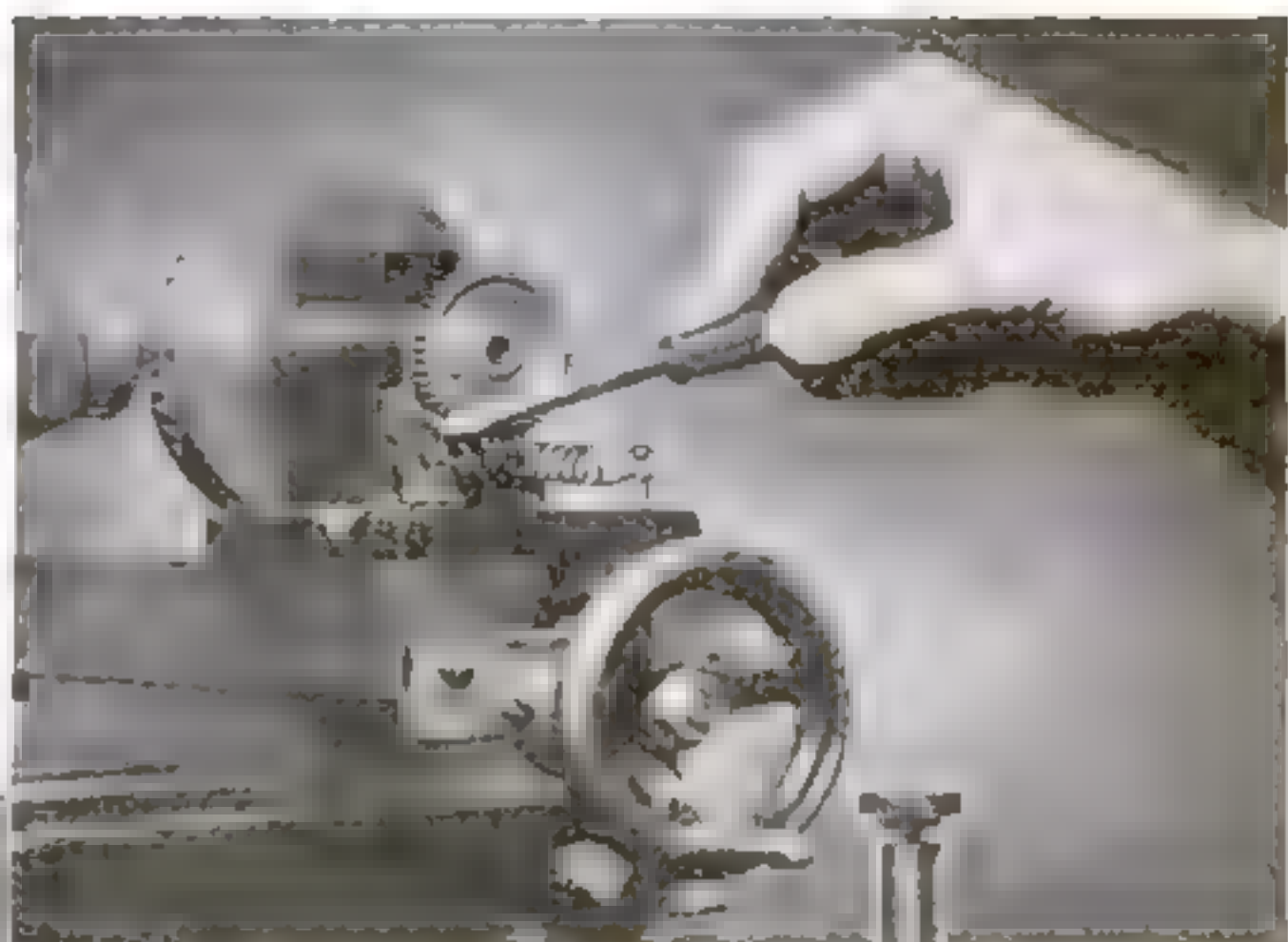
IN ORDER to build an indexing attachment for a bench milling machine, the writer drilled the necessary holes in the wheel of the attachment by the simple method illustrated.

A small 48-tooth gear wheel was chosen as the master spacing wheel. It was fastened with three 2-56 machine screws to the collar of the shaft of the home-made index head. Then a small hinge was bent to serve as a latch to engage the teeth of the gear, and held in engagement by means of a short coil spring. The index head was bolted to the table of the milling machine and the holes drilled as shown.

Although this method would not be accurate enough for precision work of a high order, it is a helpful expedient for the machinist or model maker desiring an inexpensive device.—E. S. ENSIGN.

The index head is bolted to the table of the milling machine, and holes are drilled as shown at right. Note how the hinge is bent to engage the gear teeth.

Below, the parts of the indexing attachment and, below at right, how they are assembled. The device is accurate enough for all but very exact work.



Square holder set up in milling vise, a hexagonal holder, and a sectional view.

Collet Holders Speed Small Milling Jobs

TO INCREASE the usefulness of small bench-lathe collets, a hexagonal and also a square holder for them may be made as illustrated above. Small round pieces that are to be worked upon in the miller may then be held securely. It is an easy matter to cut a "hex" or slab off a square simply by loosening the vise and rotating the holder after each cut.

This efficient little device comes in handy, too, for holding small work in a bench vise while filing or performing other operations.

How to Add Ball-Bearing Tops to Heavy-Duty Trestles

A BALL-BEARING top, applied to shop trestles, saves much back-breaking labor in handling large, heavy material.

Slope the flanges of one channel at each end and drill bolt holes if bolts are needed. Scribe the inside of the channel at the points where the balls are to rest; then make a slight seat for the balls with a blunt-pointed reamer.

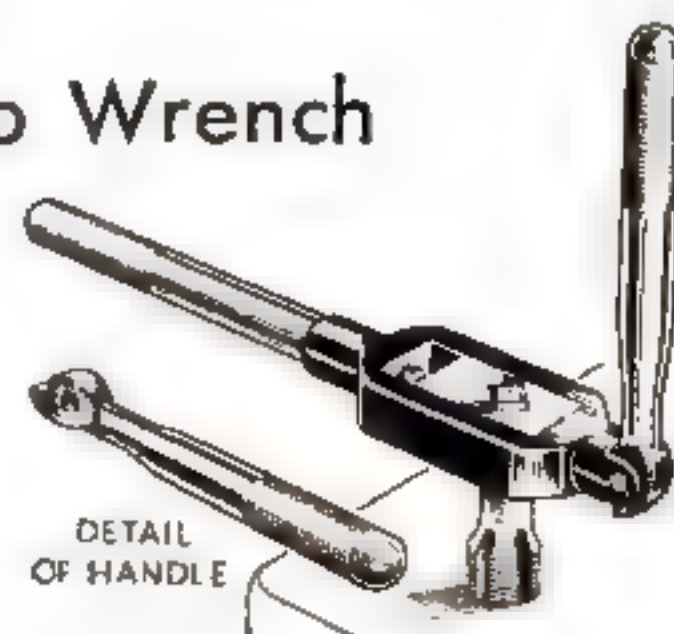
Cut holes in a second channel for the balls, invert it, and weld the flange edges together after the balls are in place. Cut flanges from the top channel back far enough so the middle part may be bent down to close the ends of the two channels. Weld these ends.—J. C. COYLE.



If the trestle is of steel, the tops are welded on; if of wood, bolts must be used.

Hinged Handle Improves a Tap Wrench

THE modern speed-up trend has struck the old tap wrench, and I have converted mine into the cranked type shown. When cutting the threads, the tap wrench is used in the customary way, but after the tap has reached the bottom or passed through the hole, the hinged handle is flipped up and the tap speedily cranked out. It is useful when holes are retapped to clean out threads.—C. H. WILLEY.



Low-Cost CRUCIBLES

for melting cast iron, brass, bronze, copper, aluminum, and other metals

Crucibles are made at trifling cost from fire clay and finely powdered fire brick



A few metal molds and crucibles made in them. The mixed fire clay and fire brick are rammed heavily into the mold, then ejected, dried, and baked



The moist, crumbly mixture is forced into the mold with a discarded half-round file

By LEO G. HALL

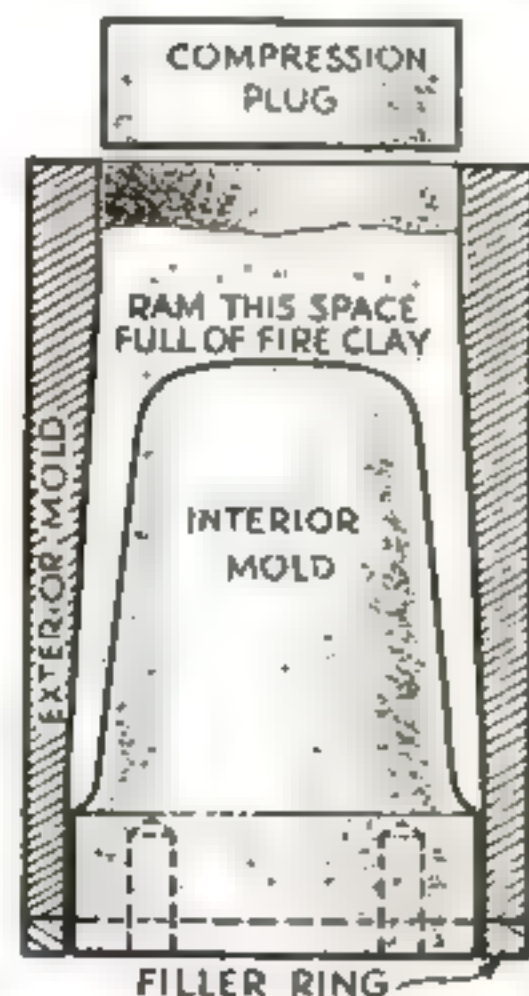
SINCE even the best crucibles do not outlast many heats, the home foundryman or furnace experimenter will find it profitable to make his own.

One method requires a mold, made in four pieces as shown in the drawing below. The outer mold and the compression plug should preferably be made of cast iron or steel. The core mold can be made of softer metal or even wood.

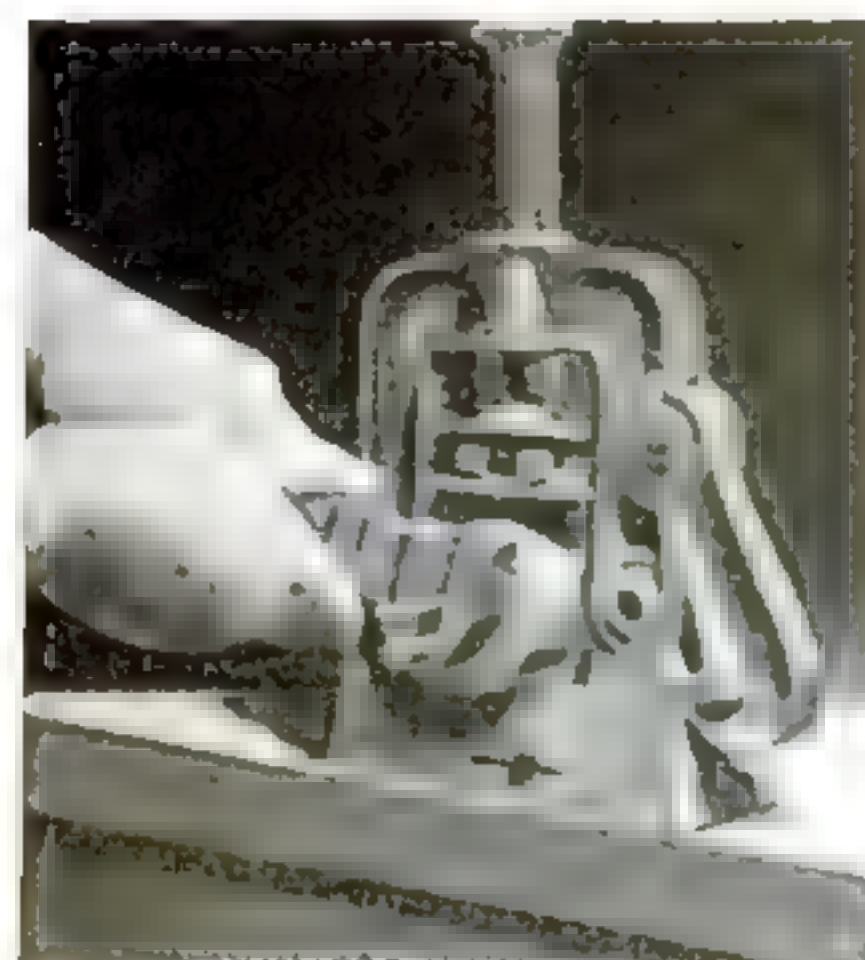
Fire-clay crucibles are satisfactory for melting brass, bronze, copper, cast

iron, type metal, white metal, babbitt, aluminum, and the like, but not steel and other very high temperature alloys or glass. The fire clay can be bought for a few cents a pound at brickyards or furnace shops. To avoid excessive shrinkage, it is necessary to dilute the clay with broken fire brick, pounded up with a hammer so that it will pass through a piece of fine window screen. Mix 1 lb. of dry fire clay thoroughly with 1½ lb. of the fire brick and add water very slowly until the mixture is barely moist and crumbly, like fresh bread. If more water than this is used, the crucible will stick to the mold.

The mixture is inserted a little at a time into the hole at the top of the outer mold, and rammed down thoroughly all around the inner mold with an old half-round file. When the mold is filled nearly to the top, insert the steel compression (Continued on page 120)

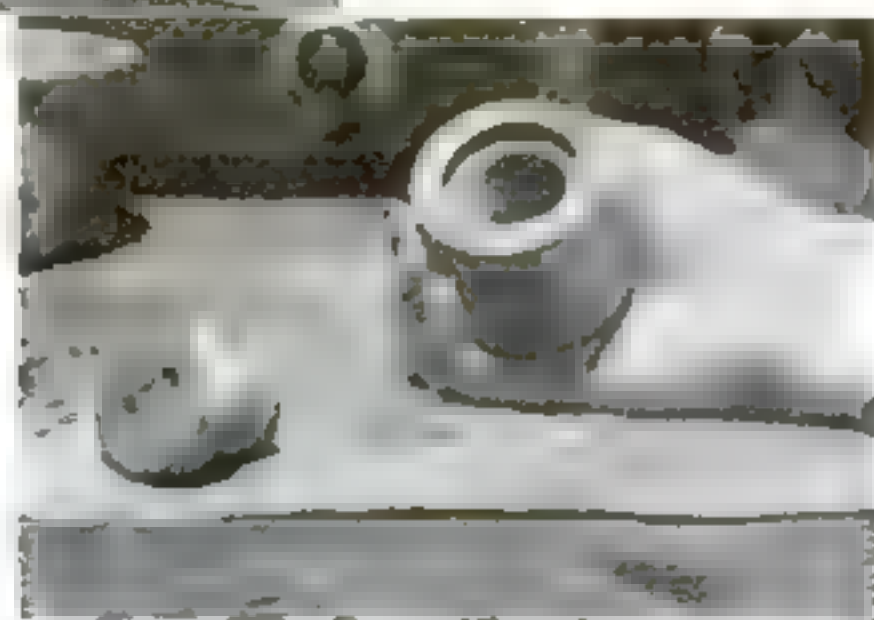


The four parts of a mold are shown in sketch at left. Note filler ring



The first step in taking out the crucible is to twist out the inner mold by using two pins

Right, the inner mold is removed, and the crucible top can be seen in the outer mold



Molds of a second type, made from plaster of Paris, and the resulting crucibles



The dry plaster mold is filled with a creamy mixture of clay. After a layer has been deposited on the inner surface, the residue is poured out

A Page of Ideas for Motorists

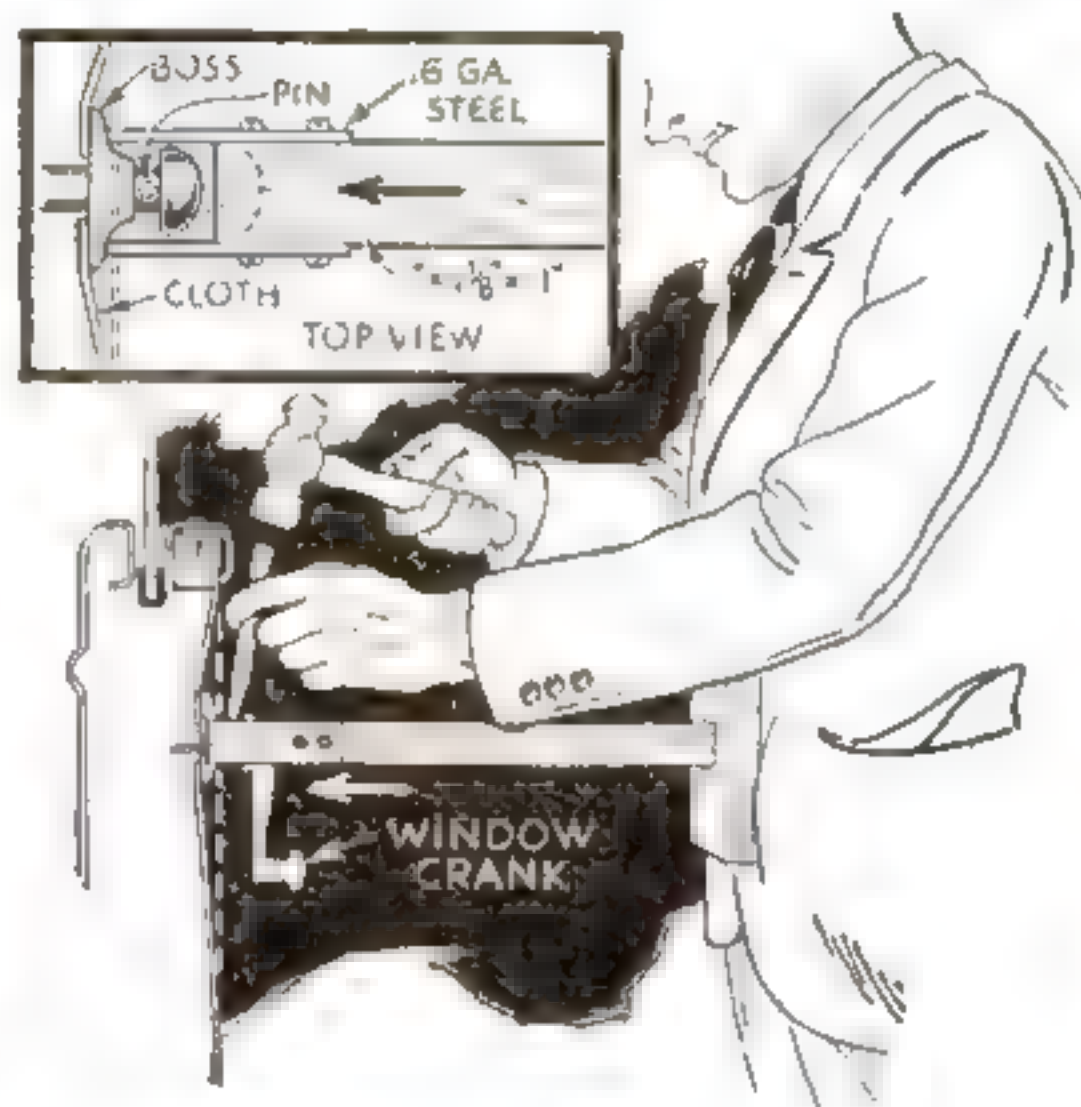
A Use for Old Rubber Gloves

WHEN the fingers of an old pair of rubber gloves wear out, cut the gloves off at the wrist, coat the ends of the remaining gauntlet with rubber-patching cement, and roll them back for two or three turns. Pulled over the coat or shirt cuffs, the rubber gauntlet affords protection for coat or shirt sleeves while you are washing the car or tinkering around greasy and oily parts of the motor—N. N. A.



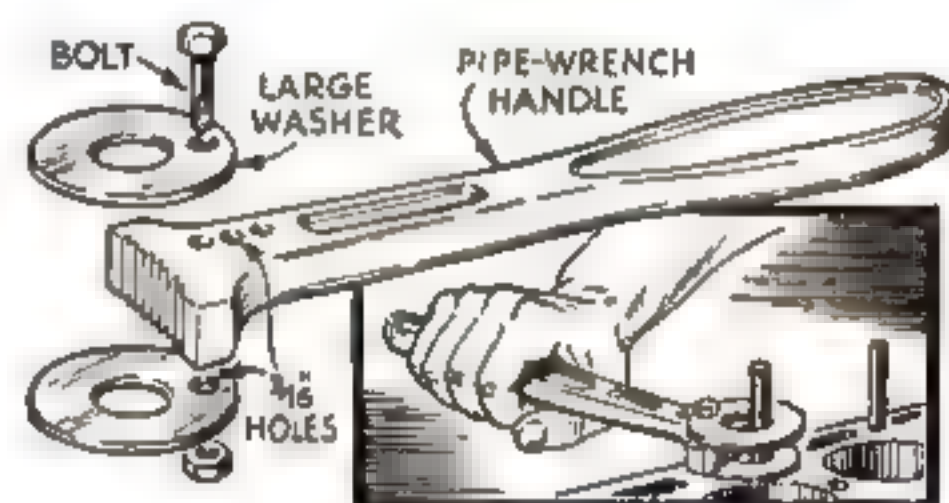
Jig Helps Remove Door Handles

REMOVING door handles or window cranks on many makes of automobiles is made easy with a homemade jig, shown at the right, designed to enable one man to force the decorative flange or boss back while leaving both hands free to wield a hammer and punch to drive out the pin. The simple unit consists of a shank of wood screwed to a flat breastpiece, with metal prongs attached to the opposite end and covered with cloth or tape to prevent scratching the metal fittings. The diagram shows how the jig is used.—W. C. W.



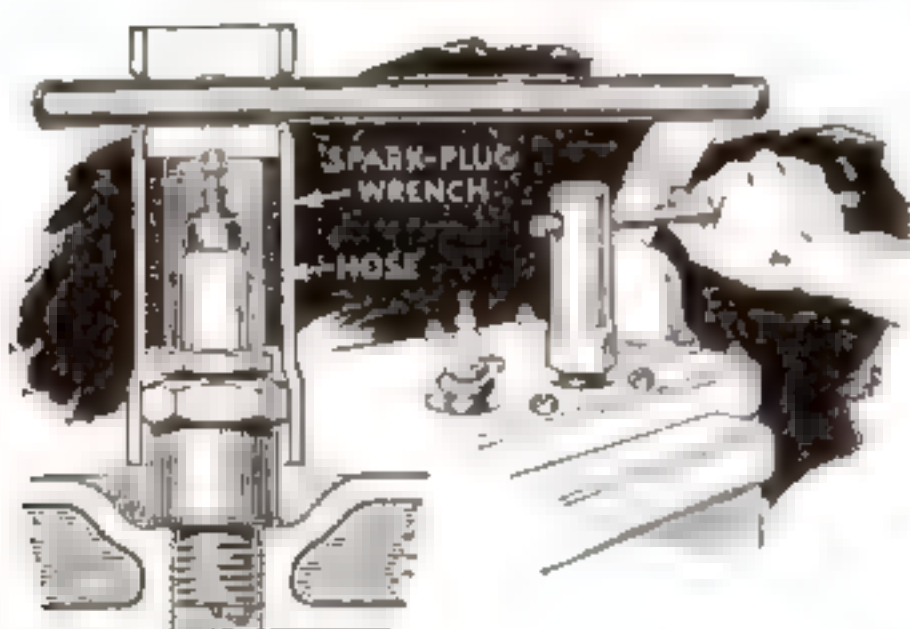
Handy Stud Wrench Is Easy to Make

A HANDY stud wrench can be made by boring a hole just back of the toothed shank of a discarded pipe-wrench handle, and bolting two large washers to it on opposite sides, as shown below.—A. W. H.



Washers mounted on a pipe-wrench handle enable it to grip cylinder-head studs

Rubber Cushion Protects Spark Plugs

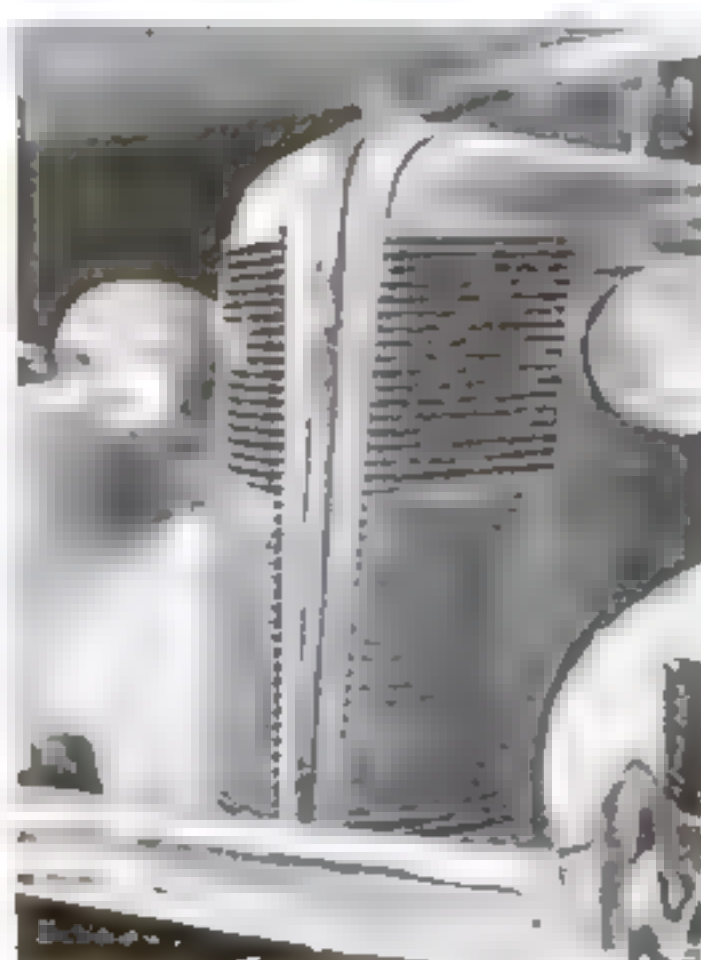


BECAUSE socket-type spark-plug wrenches sometimes break the porcelain around the plug as they are slipped on or off, I cut a short piece of rubber hose to fit snugly inside the wrench. Forced into the tool so that it clears the lower shank that grips the base of the plug, the rubber hose within the hollow tool acts as a cushion to protect the plug's porcelain insulator from accidental breakage.—A. M. C.



Celluloid Radiator Cover Shows Decorative Grill

DECORATIVE grill work on the radiator fronts of new cars will not be hidden if you make a cold-weather radiator shield out of heavy celluloid instead of some opaque material. Cut to shape, the transparent celluloid is fastened to the front of the radiator with fine wire or with wire clips as indicated in the drawing at the right. Additional sections may be cut and stored conveniently under the front or rear seat of the automobile, or in the garage, for adding in extremely cold weather.—A. S. L.

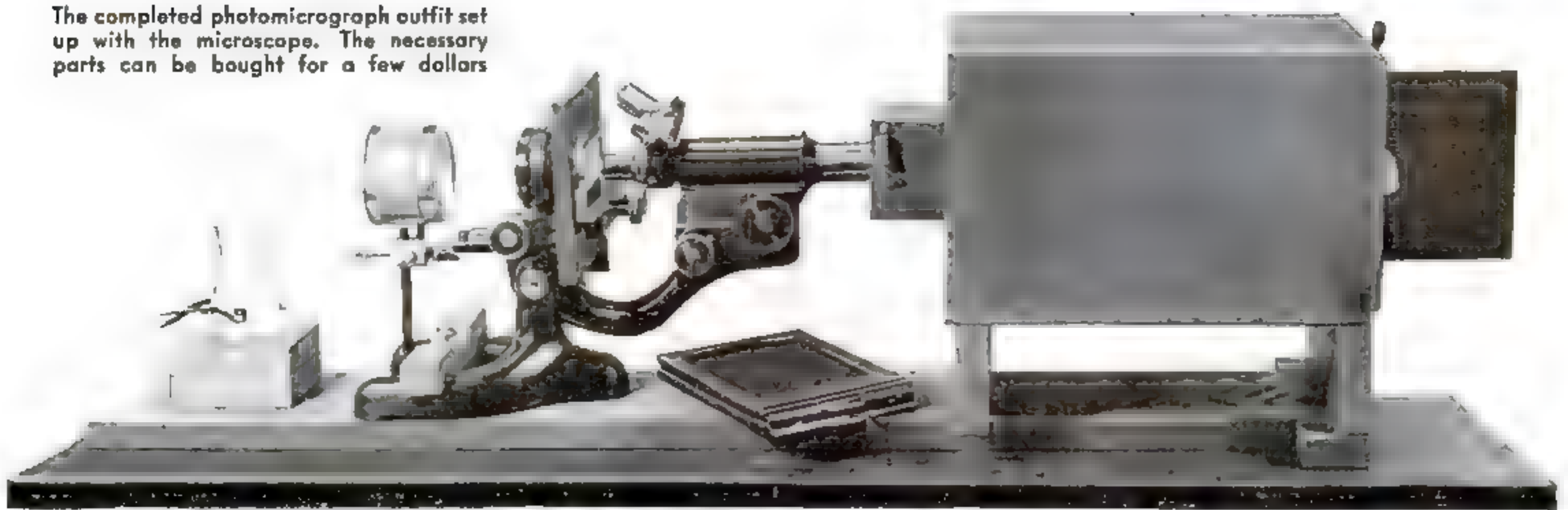


Caster Forms Roller for Tire Patches

INSTEAD of pounding or rubbing cold patches applied to inner tubes, I've found that I get a more lasting and airtight job by using the roller pictured above. The unit is made simply by inserting a furniture caster wheel into a hole bored in the end of a handle of an old broom or mop.—F. F.

Hook a CAMERA to

The completed photomicrograph outfit set up with the microscope. The necessary parts can be bought for a few dollars



IT'S a lot of fun looking at things through your microscope. You won't argue about that, after having explored the mysteries of pond water, bits of hair, and the thousand and one other things there are to examine. But merely looking is only half the fun. Equally fascinating is the business of recording your discoveries on photographic film.

Don't let the term "photomicrography" scare you, for it actually is no more difficult to make a good photomicrograph of a bee's knee than it is to make a good snapshot of your Uncle John. All you need is your microscope and a little additional equipment, most of which you can make yourself.

In addition to your micro-

scope, you must have a source of light, a piece of photographic film, and some arrangement for holding the film so that only light passing through the microscope strikes it. Some way of focusing the image sharply on the film also is necessary.

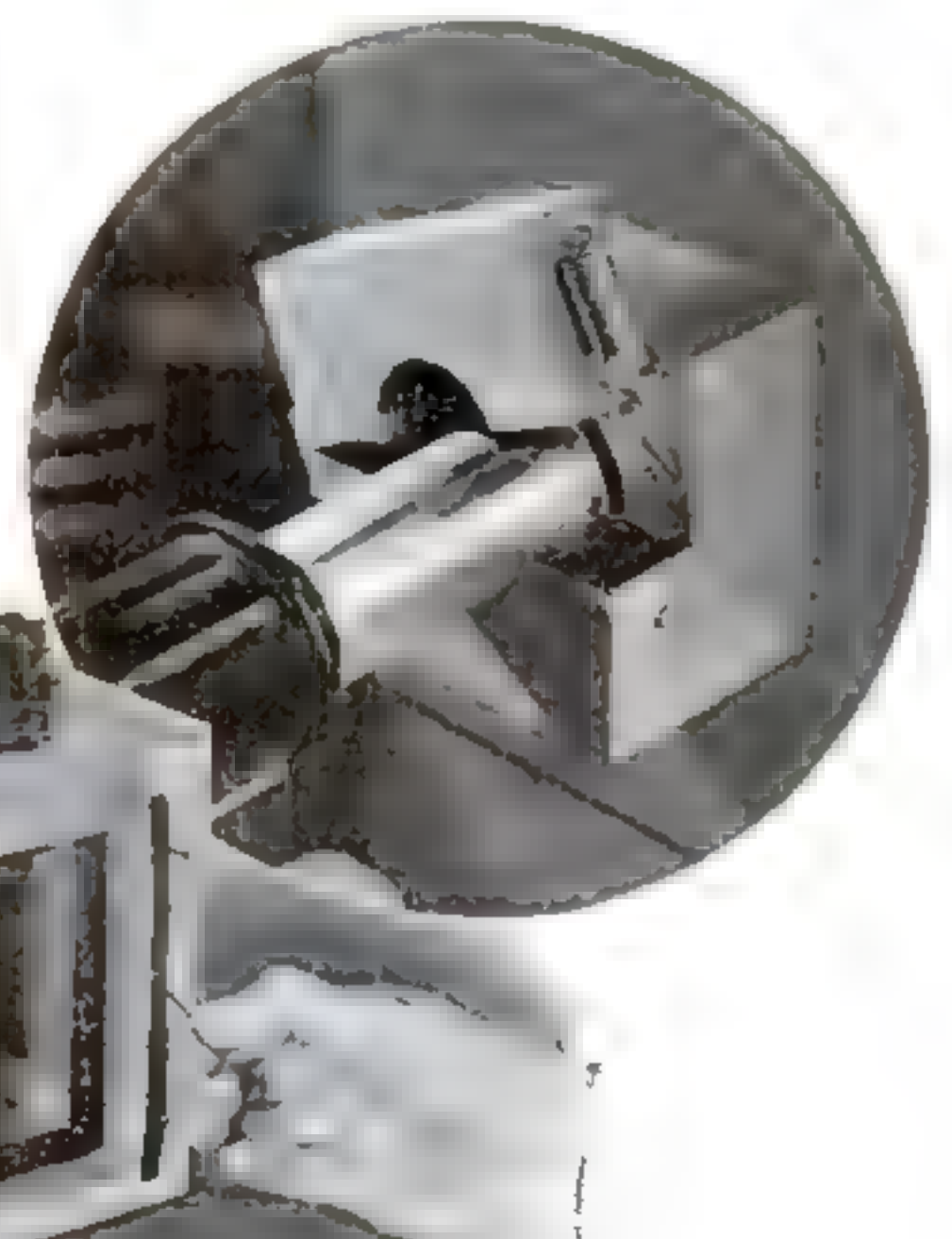
Maybe this sounds too simple. But not long ago I visited a young chemist who, with no more equipment than this, was turning out photographs of microscopic subjects that would make a professional photomicrographer with a room full of equipment sit up and stare. His camera was made from a store box, and you still could see the marks of the saw that ripped the boards. He apparently was violating or ignoring a lot of so-called rules; but he was getting pictures—mainly because he had learned, by trial and error, just how to handle the equipment he had.

The first thing is to make the camera. This consists of a light-tight

At the left, above, are reproduced two photographs made with the inexpensive camera illustrated. The upper picture shows a plant louse, the lower one nematodes in pork muscle. Good lighting is not difficult, even at low magnifications



Construction details of the camera box, film opening, and split-block coupling to take the microscope tube



Your MICROSCOPE

WITH HOMEMADE APPARATUS COSTING ONLY
A FEW DOLLARS TO BUILD, YOU CAN RECORD
YOUR DISCOVERIES IN PHOTOMICROGRAPHS

By MORTON C. WALLING

wooden box, shaped somewhat like a shoe box, mounted in a horizontal position on a wooden base. The box can be made of any material that is rigid but not too heavy, such as quarter-inch lumber from a store box, or one of the composition panel materials. Dimensions are not very important, but, as a suggestion, the box can measure ten inches long by six inches square, like the one shown in the photographs.

Against one end of the box rests the eyepiece of the microscope, which has been broken over to a horizontal position. If your instrument doesn't have such an adjustment, mount it on a support that will hold it horizontal. Either the microscope or the box is blocked up, so that the two are centered with respect to each other.

There are various ways of coupling the microscope so that no stray light will leak into the camera around the end of the tube. One simple method is to make a little tube of black cloth, preferably several layers of it, and provide one end with a draw string, a coil spring, or a rubber band sewed into the seam. This fits around the microscope tube. The other end is tacked over a one-inch hole bored in the box end. Another method, which permits the microscope to be removed easily for visual observation, is illustrated. A split block

having a hole large enough to fit around the microscope tube is fastened to the box end. One half of the block is hinged to permit it to swing upward, releasing the microscope so that it can be removed or tilted to an upright position for visual observation.

In the other end of the box, cut an opening for the film or plate. A convenient size film is $3\frac{1}{4}$ by $4\frac{1}{4}$ -inch. Although it is possible to make cut-film holders or film-pack adapters from metal or wood, you will save yourself a lot of trouble by purchasing them already made. Frequently you can get good used ones at a photographic shop.

After deciding on a film size, cut an opening in the end of the box slightly smaller—say an eighth of an inch all around—than the film dimensions. On the outside, around this opening, mount strips or other devices for fastening the focusing screen and film holders in place. The illustrations show the arrangement for holders which have grooved edges. The focusing screen can be simply a piece of ground glass mounted in a wooden frame in such a way that the distance from the ground surface of the glass to the microscope-eyepiece opening or any other fixed point of the camera is

exactly the same as the distance from the film surface to the same point when the film holder is substituted for the focusing screen.

Fasten the base of the microscope firmly to the base of the camera, so that the tube will be held rigidly in position. Adjust it so that the tube is exactly perpendicular to the film surface, and directly opposite the film center. A cross bar held by a bolt and winged nut anchors the microscope base, as shown.

Paint the inside of the box and all parts of the film-holding equipment a dull black. You can make a suitable paint by mixing powdered lampblack or drop black with shellac or lacquer. The proportion of pigment to vehicle should be such that the surface is completely free from sheen when dry.

Now, with this and nothing more, you can make photomicrographs, using daylight (not direct sunlight) for illumination. Clamp a slide to the microscope stage, insert the focusing screen in the back of the camera, and adjust the sub-stage mirror of the mi-

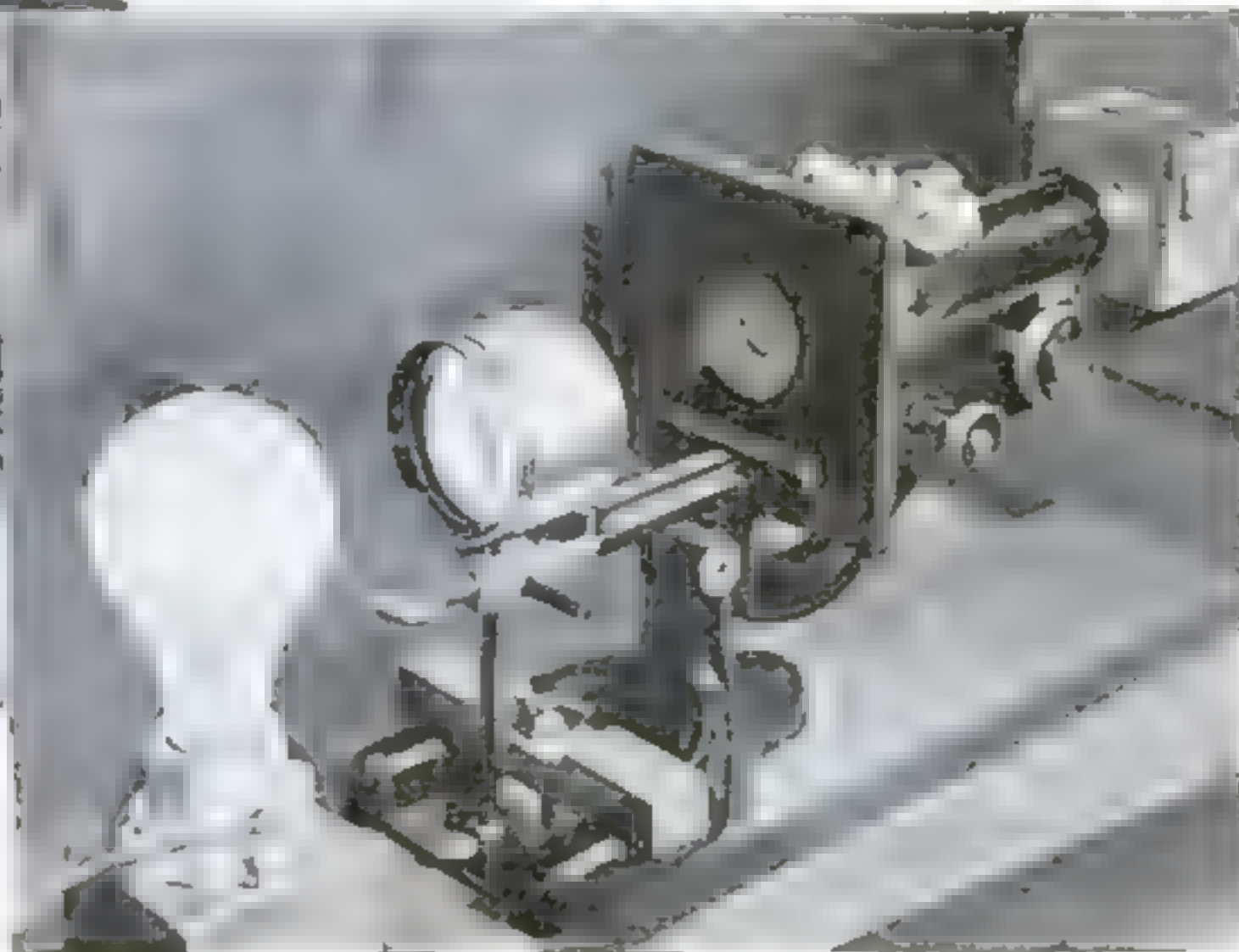
(Continued on page 118)

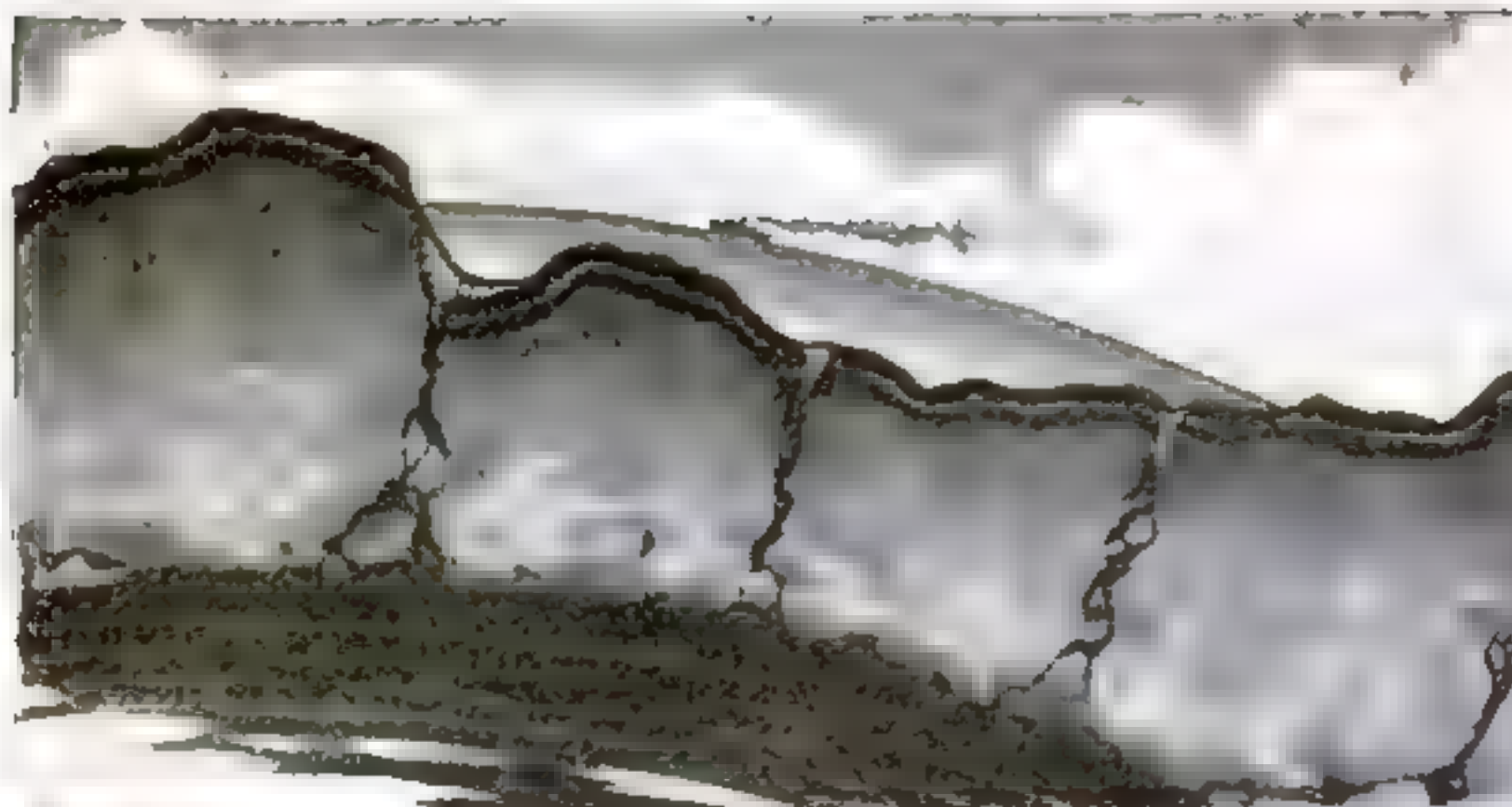


This is a small photomicrograph outfit of the type that is commonly sold for use with inexpensive amateur microscopes

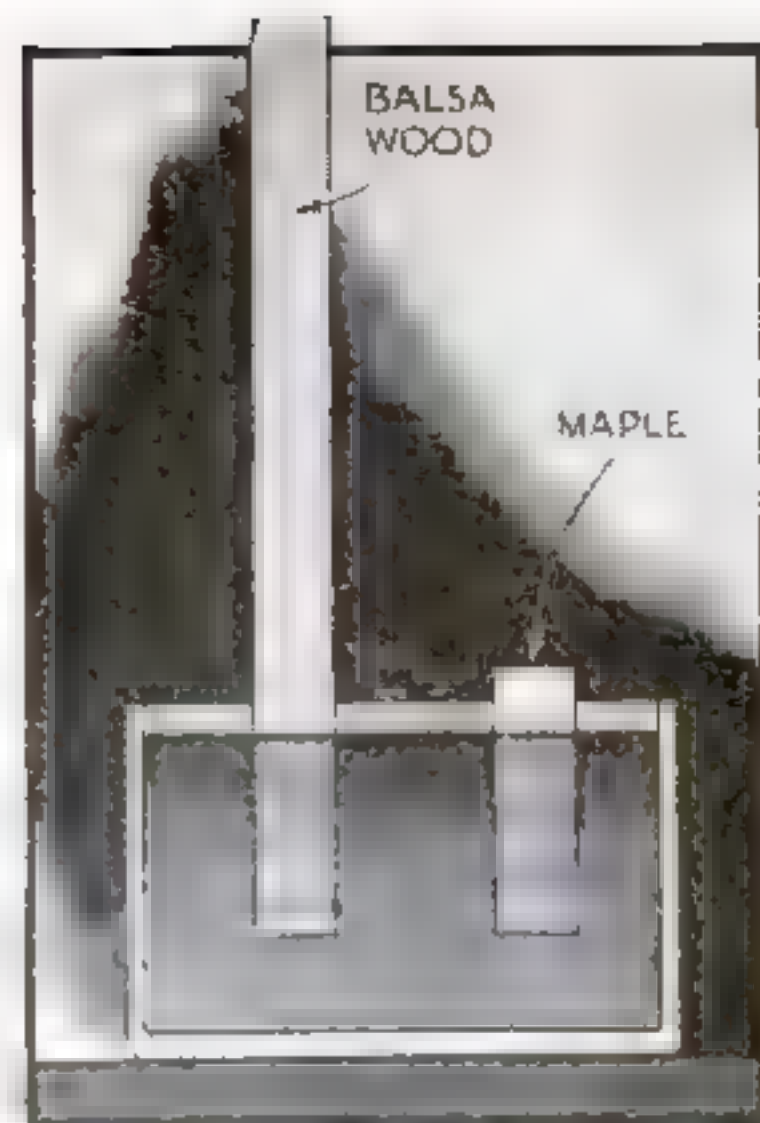


How a plate holder is fitted into the place provided for it. Right, the illumination system, consisting of the photoflood lamp with a condenser





Mammoth blocks of the earth's crust, rising or settling in an inner sea of molten rock, may cause earthquakes



Two blocks of wood, of equal weight but different density, illustrate how parts of the crust float high and create mountains



MAKING EARTHQUAKES ON A SMALL SCALE

Clay models of mountain and plain areas are balanced on the pans of a photographer's scale. When a miniature rainstorm washes sand off the mountain onto the lowland, the sections change position as at the right



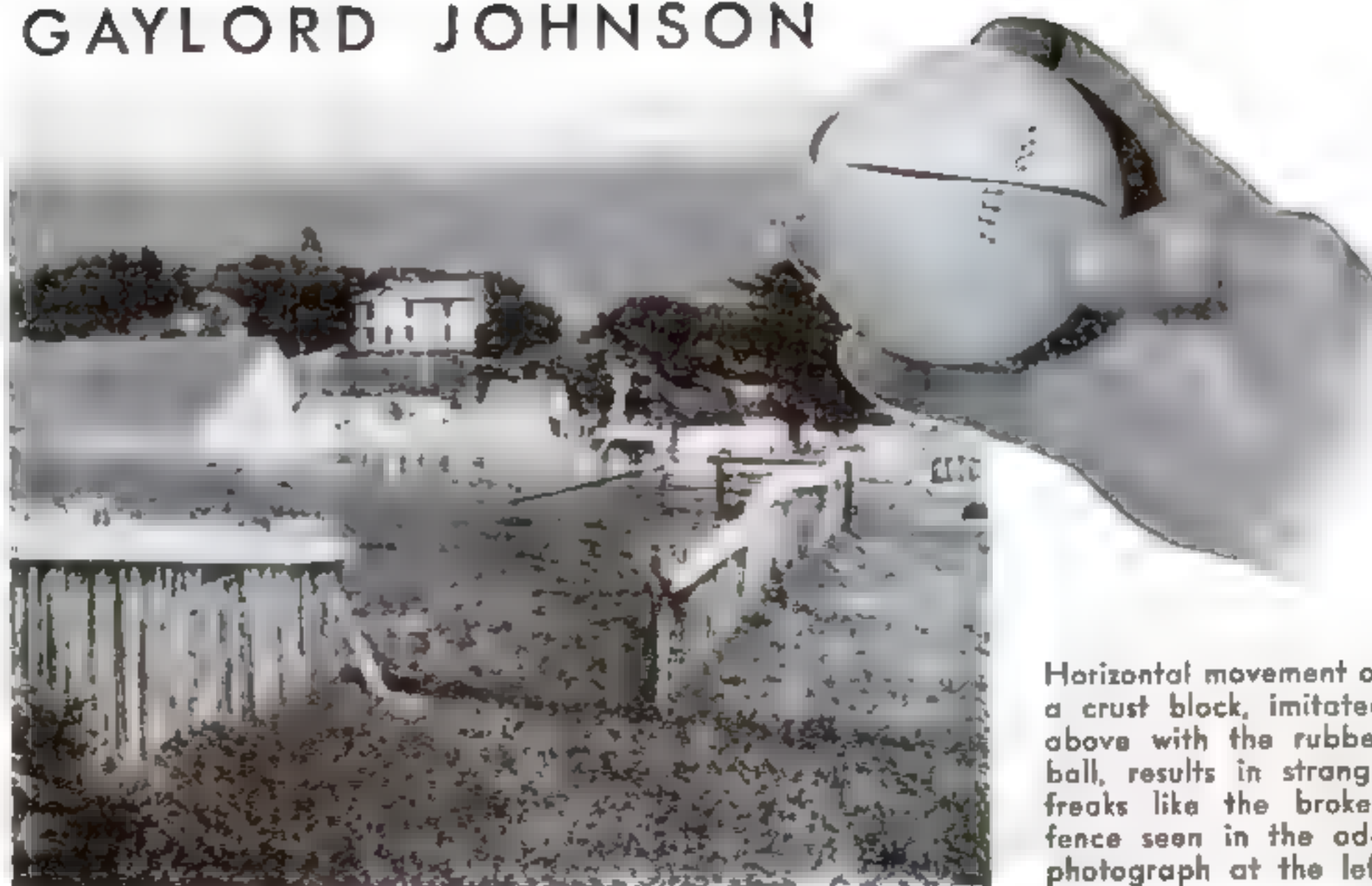
TABLE-TOP EARTHQUAKE SHOWS

How Rain May Cause

By GAYLORD JOHNSON

EVERY hour, all the year round, some part of the earth's surface is shaken by an earthquake. In specially susceptible countries, such as Japan, a single seismograph will record an average of four distinct shocks each day. Most of these tremors are too faint to be noticed, except on the tapes of sensitive instruments. Others have no effect beyond rattling dishes and frightening timid souls. Only the most serious, resulting in property damage or loss of life, are reported in the newspapers.

Why is the rocky skin of our globe so restless and jittery? How does science explain this most startling of natural phenomena? On your kitchen table, with a miniature section of the earth's crust mounted on a photographic balance, you can produce an ant-size earthquake and demonstrate one of the



Horizontal movement of a crust block, imitated above with the rubber ball, results in strange freaks like the broken fence seen in the odd photograph at the left

theories advanced by geologists to account for such catastrophes as the famous Lisbon, Portugal, quake of 1755 and the disaster that razed San Francisco in 1906.

If you accept their view, the next time you read of a great city being reduced to ruins, and hundreds of lives being snuffed out by an earthquake, you will view it as the tragic last act of a drama that opened with an innocent-appearing rainstorm!

To understand this startling statement, you must picture the earth's crust as composed of millions of separate blocks, joined to one another at the surface but floating individually upon an underlying ocean of plastic rock, or lava, whose consistency is like that of asphalt. The size of the individual blocks may be as small as fifty, or even twenty-five miles on a side. There are bound to be blocks slipping up and down, grating against their neighbors—and causing tremors in the earth.

As you know from experience, an asphalt pavement resists denting by quickly passing, hard-tired vehicles. However, the wheels of a heavy wagon resting for some time in one spot will leave depressions in the surface, particularly on a warm day. In the same way, the earth's asphaltlike inner sea of plastic stone yields and flows slowly in response to the weight of the continental and sea-bottom blocks of the rocky crust, which rest partly immersed in it.

And here is a most surprising thing. You would naturally expect a mile-square vertical block of the earth's crust to be heavier if cut out of a mountainous region, than when taken through the thickness of the crust under the plains or the sea bottom. But, as a matter of fact, it is lighter. The jagged mass of tumbled rocks in the mountain is really less dense and hard,

and therefore weighs less, than a similar area of sea floor. The proof that the mountain is lighter to the cubic mile is that it floats higher in the sea of lava than the sea bottom does.

This can be illustrated very clearly with the help of two small square rods of wood having very different degrees of hardness, or density. One, let us say, is balsa wood, the other hard maple. They are both carefully planed to a half inch square, and the balsa rod is made sufficiently longer than the maple one to weigh exactly the same. It has to be about three and a half times as long, as maple is about that much denser than balsa.

Now, let us support both rods side by side, with their weights floated in a small chemical graduate full of water.

What happens? The two rods float with their lower ends exactly on a level—both immersed in the water to the same depth. The top ends extend above the water's surface to distances exactly proportional to their relative density or hardness.

When you think about it a minute, you can see that this is just what you should expect, for each rod is a half inch square and both sink to the same depth. In other words, they displace the same weight and volume of water, since they both weigh the same. In this way, nature has been weighing the rocks of the earth's crust for millions of years by floating them in the lava sea.

Each square mile of mountain floats high, like the rod of balsa, because its

rocks are soft and light. Each square mile of sea bottom or dry-land plain floats low, because its underlying rocks are more dense and hard.

But why do not all the different blocks in the earth's crust eventually find the levels at which they can float, and settle down there permanently? If that happened, the grating and sliding of the blocks upon one another's sides would stop—and all earthquakes would stop along with them.

The answer is that none of the blocks in the earth's crust can remain permanently quiet, because their weight is constantly changing. To see how it changes, you need only look at a photograph of some great river gorge like the Grand Canyon of the Colorado River. All the space in this great ravine, thirteen miles wide and a mile deep, was once solid, level, stratified sandstone and limestone rock. Where has the rock gone?

That is where rainfall, in the form of running water, enters the earthquake picture. The Colorado River has gradually broken up the solid layer of rock, pulverized it into sand, and carried it out into the ocean. When you think of the millions *(Continued on page 132)*

ONE GOES UP, ONE GOES DOWN

In most faults, or breaks in the earth's crust, one block is pushed above another as demonstrated with the ball. Below, such a break has occurred in a street of cobble-stone paving

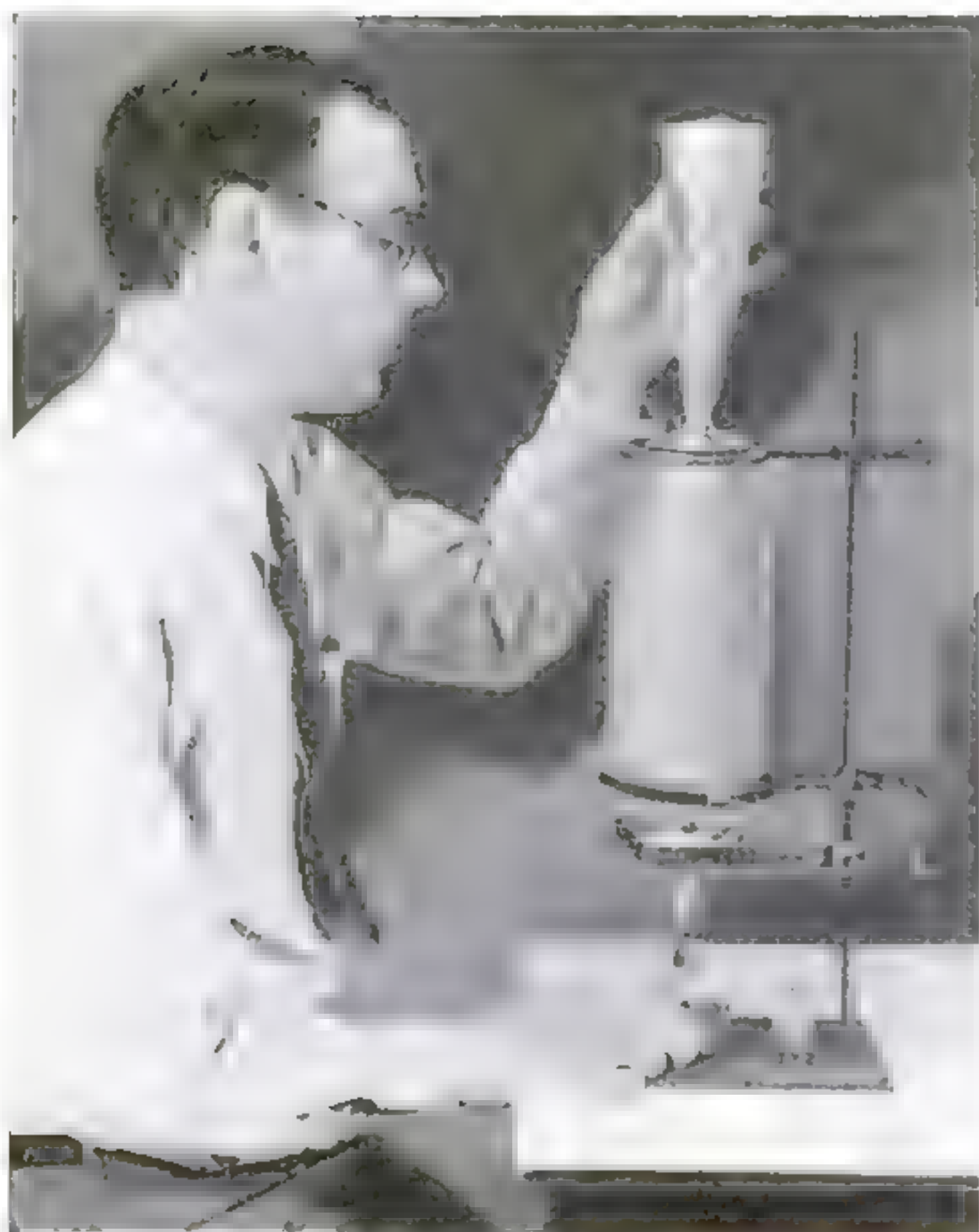


Typical damage wrought by an earthquake. Most of the destruction is produced by vibrations

Great Disasters



Thrilling Stunts with a



Etching your laboratory glassware is only one of the many possibilities offered by compounds of the active element fluorine

By **RAYMOND B. WAILES**



HOW TO ETCH GLASSWARE

A beer glass, coated with wax on which the desired markings have been drawn, being exposed to hydrofluoric acid vapor

would obtain. When they tried a mixture of fluor spar and strong sulphuric acid, distillation produced a strange substance that ate away the glass of the vessels. The great French physicist and chemist, André Ampère, rightly suggested that the substance was a combination of hydrogen and a new chemical element, which received the name of fluorine. Subsequent investigators used distilling apparatus made of metal, usually lead or platinum, which the distilled product—hydrofluoric acid—does not so readily attack.

You can easily duplicate their experiments with a homemade retort and condenser, fashioned from a piece of lead pipe about an inch, or a little more, in inside diameter. Crimp one end to close it securely and place in this end about half an ounce of powdered fluor spar or manufactured calcium fluoride, together with a fluid ounce of strong sulphuric acid. Bend the pipe carefully to form an inverted U. Melt some candle wax and coat the inside of a small bottle with it. Fill the bottle with water and pack it in ice and salt, to keep the water cold. Then immerse the open end of the lead pipe, to a depth of not more than half an inch, in the water in the bottle. Heat the crimped end containing the chemicals with an alcohol lamp, or a low Bunsen-burner flame, for about

NOT long ago, a noted chemist told of a solvent powerful enough to dissolve nearly every known material. If the water on the earth were replaced with a liquid called selenium oxychloride, he said, we should have to carry umbrellas made of glass, platinum, or tungsten whenever it rained, for those are about the only substances that the fluid does not attack. There is a more familiar chemical, however, so corrosive that it could even eat its way through a glass umbrella. Its name is hydrofluoric acid, and it is one of the interesting compounds of the highly active element fluorine with which you will enjoy experimenting in your home laboratory.

Probably you already have at least a speaking acquaintance with the chemical family to which fluorine belongs—the "halogen group" including chlorine, bromine, and iodine. Pure fluorine, like chlorine, is a greenish-yellow gas. You will usually encounter it, however, in the company of other elements with which it forms salts called fluorides, just as chlorine commonly is found in the form of salts called chlorides. The crystalline min-

eral variously called fluor spar and fluo-rite consists of calcium fluoride, a compound of calcium and fluorine. From natural or artificially prepared fluorides you can make the glass-eating chemical, hydrofluoric acid. This substance in turn will yield a strange gas, silicon tetrafluoride, which has properties that you will find worth while investigating.

Pioneers of chemical research kept their crude apparatuses busy distilling all manner of concoctions to see what they

FLUORIDE IN ROACH POWDER

Most roach powders contain fluoride, as proved by the test shown at the right. In this form, the chemical can be used with sulphuric acid to etch microscope slides



Glass-Eating Chemical

an hour. Hydrofluoric acid will be produced in the form of a vapor, and will dissolve in the water in the bottle, yielding a solution of the acid. The wax coating of the bottle prevents the glass from being attacked by the solution, which always has to be kept in containers lined with paraffin, rubber, or lead.

To watch the acid actually dissolving glass, first hold a piece of glass tubing in the blue flame of your Bunsen burner and draw it out into a filament. If you break off a piece of this glass thread and hold one end of it in the solution of hydrofluoric acid, you will see the glass disappear before your eyes.

TAKING advantage of the way hydrofluoric acid attacks glass, you can etch lettering, markings, and fancy designs on clear-glass tumblers, vases, microscope slides, and various pieces of chemical glassware. First coat the glass with molten paraffin wax, obtained from a candle, and let the wax cool. Then, with a needle or a keen-pointed tool such as engravers use, cut away some of the wax to expose parts of the glass surface in the pattern you wish. This forms a sort of stencil; the cut-away portions will allow the acid to etch the glass, while the parts on which wax remains will be unaffected. After the article has been exposed to the vapor of hydrofluoric acid or to a liquid solution of it—which may be produced locally on the surface of the glass by one of several methods—all the wax may be removed and you will find the design permanently imprinted.

To produce a frosted (rough-grained) initial or ornamental design on a plain beverage glass, for example, gently heat a little fluor spar or calcium fluoride

with some strong sulphuric acid in a lead dish or tray. The glass, with the letter or pattern cut in its wax coating as just described, is supported just above the dish—so that the vapor of hydrofluoric acid circulates around it—within a can or cardboard carton open at top and bottom. Examine the glass from time to time to determine the progress of the etching, which will require from ten to thirty minutes.

A microscope slide may be titled, when the letters have been cut in the wax coating, by placing upon them a pinch of powdered fluor spar or calcium fluoride. Touch this with several drops of strong sulphuric acid, and let the slide stand about ten minutes before cleaning off the chemicals and the wax. This chemical mixture, which gives smooth-etched lines, may also be used to put volume and capacity markings on your test tubes and beakers. The sharpest and clearest lines are obtained by heating the wax on the glass and letting it cool before you mark it.

Other chemicals that you can use with sulphuric acid for etching glass by direct contact include sodium fluoride, potassium fluoride, ammonium fluoride, and ammonium bifluoride. An alterna-



A crystal of fluor spar exhibits thermoluminescence, shining in the dark when heated. Here an electric heater is employed

tive preparation consists of a mixture of barium sulphate, sodium fluoride, and strong hydrochloric acid, made into a paste which should be left on the glass for an hour or so.

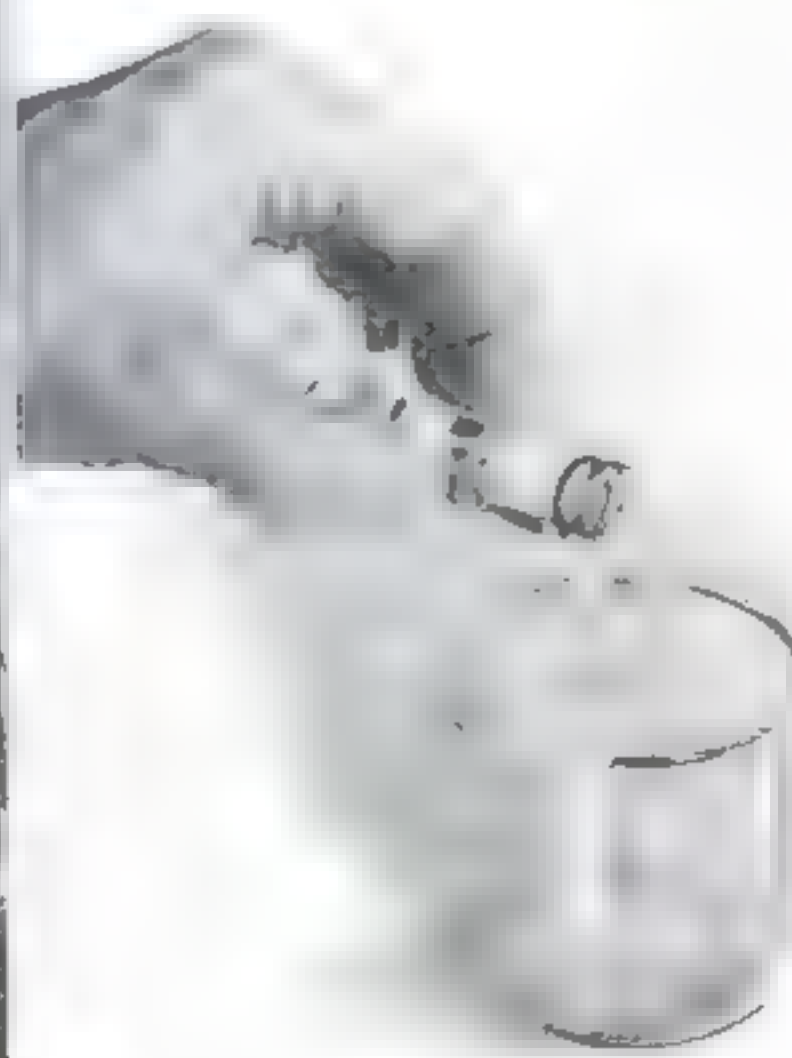
Instead of securing the fluorides for your experiments from a chemical supply house, you may, if you wish, obtain fluor spar or fluorite from a dealer in minerals. There are purple, green, and colorless varieties of the crystals, the colorless ones usually appearing blue when light shines through them. You can purchase a remarkably good single crystal for twenty or thirty cents and use it in a beautiful and showy experiment, for it will glow in the dark when gentle heat is applied to it.

To observe this striking phenomenon, known as "thermoluminescence," the experiment is best performed in a totally darkened room. Place the crystal on an improvised sand bath consisting of a half inch of sand in a tin-can lid, and heat it gently from below. After each minute or so, turn off the heat and observe the crystal (Continued on page 126)



"SAND GAS" PLUGS A VIAL SO WATER WILL NOT POUR

A vial of water, exposed to silicon tetrafluoride generated by the apparatus at the left, is plugged with a coating of precipitated silicic acid



HOME TESTS EXPLAIN Laws of Science



Loop of
Copper Acts
as Compass



BEND a copper wire into a loop, stick the ends through a cork, and solder a small copper plate to one end and a zinc plate to the other. Now, if you float the apparatus in a dilute solution of sulphuric acid, the loop will turn so its axis points north and south, owing to a magnetic field set up by current flowing from the crude electric cell formed by the metal plates and the solution.



Test Your Lamps for Glare

TO TEST your household lamps for glare, bend a strip of cardboard as shown above and cut a quarter-inch hole in the center of one end. If you hold this apparatus several feet from a lamp, so that the light shines through the hole, the greater the glare the sharper will be the spot of light formed on the "screen."



Mirror Helps Measure Focal Length of Lens

A MIRROR can be used to make a quick measurement of the focal length of a magnifying lens. Hold the lens in front of the mirror and adjust its distance from the eye until the reflection of your pupil appears to cover the whole surface of the lens. This distance then equals the focal length.

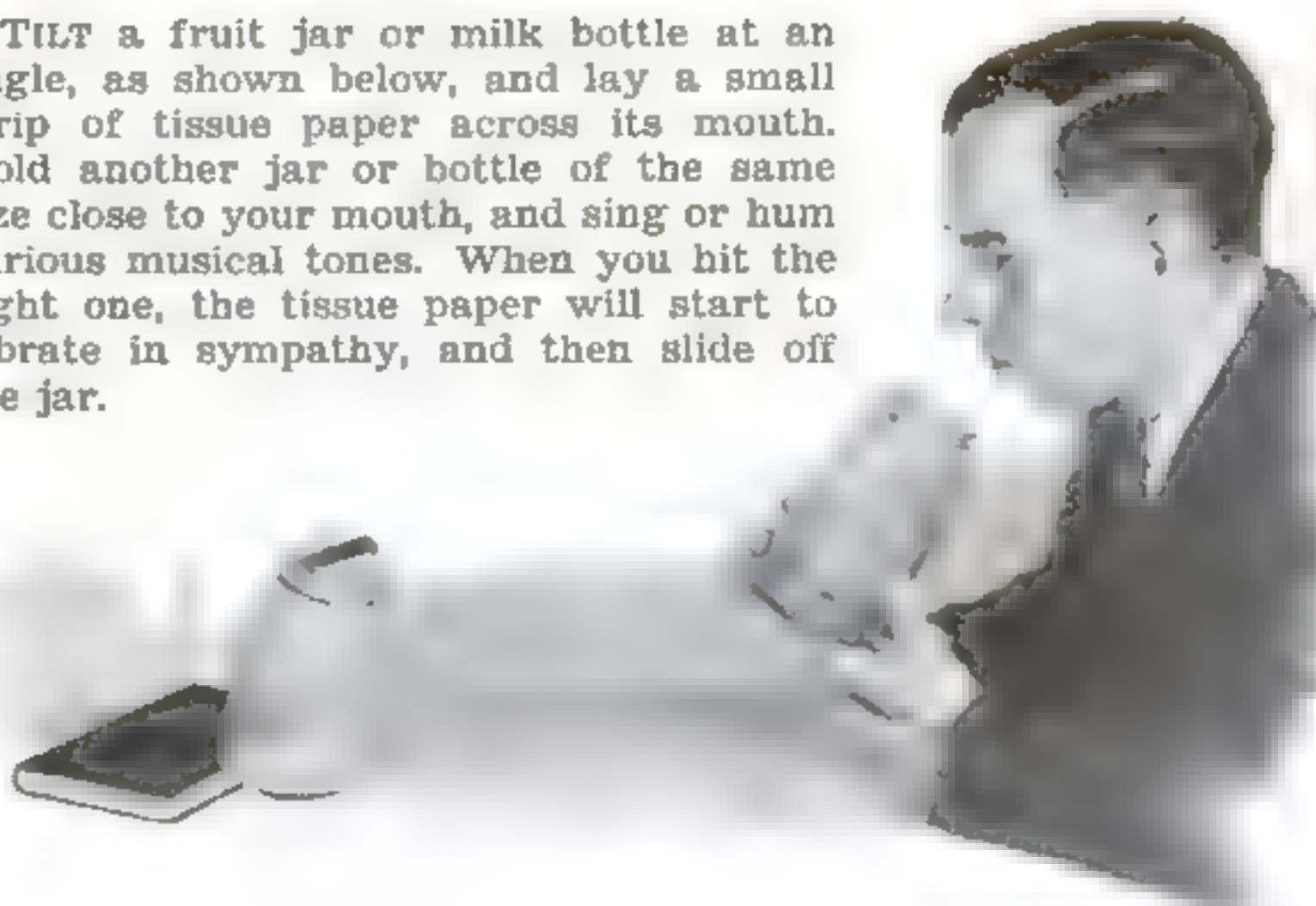


How Radio Beacons Guide Flyers

TO DEMONSTRATE how an airplane pilot uses a radio direction finder by turning the loop antenna mounted on the plane's fuselage, connect a coil of a dozen turns of wire in series with a heater unit and a source of alternating house current. Connect another wire coil to a pair of radio earphones and maneuver it in the vicinity of the first coil. When it is parallel with the first coil, you will hear an intense hum in the phones. Turn it on its axis, and the strength of the hum diminishes.

Fruit Jars Demonstrate Resonance

TILT a fruit jar or milk bottle at an angle, as shown below, and lay a small strip of tissue paper across its mouth. Hold another jar or bottle of the same size close to your mouth, and sing or hum various musical tones. When you hit the right one, the tissue paper will start to vibrate in sympathy, and then slide off the jar.



ALL-WAVE Electric Radio

USES TWO METAL TUBES

By Arthur Miller



These are the two metal tubes employed in the receiver

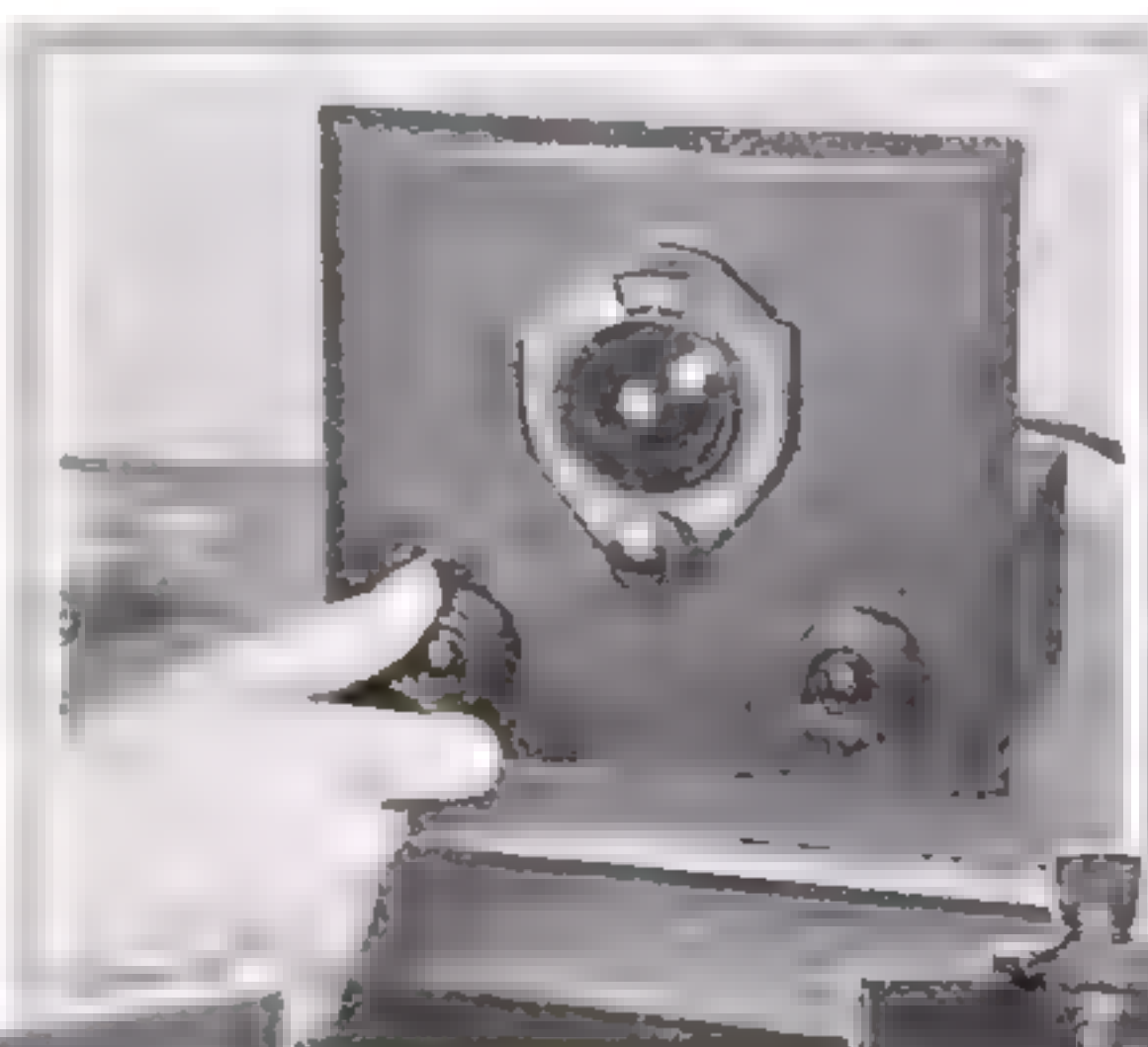
DESIGNED for the radio amateur who wants a compact, efficient, yet inexpensive all-electric receiver to replace a battery-operated set, the two-tube, all-wave radio illustrated provides exceptional power and efficiency in a small space.

Operating on A.C. or D.C. current, the unit employs a 6J7 metal tube as a detector and a 6H6 metal tube as a rectifier. As shown in the diagram, the two plates and two cathodes of the 6H6 are connected in parallel, to provide the necessary direct current, a two-watt, 10,000-ohm resistance and a midget eight-microfarad electrolytic condenser serving as the filtering system. Parts are placed as shown in the photographs below, the 360-ohm filament resistor being built into the power cord. In wiring the cord, the black wire should be connected to the tube plates,

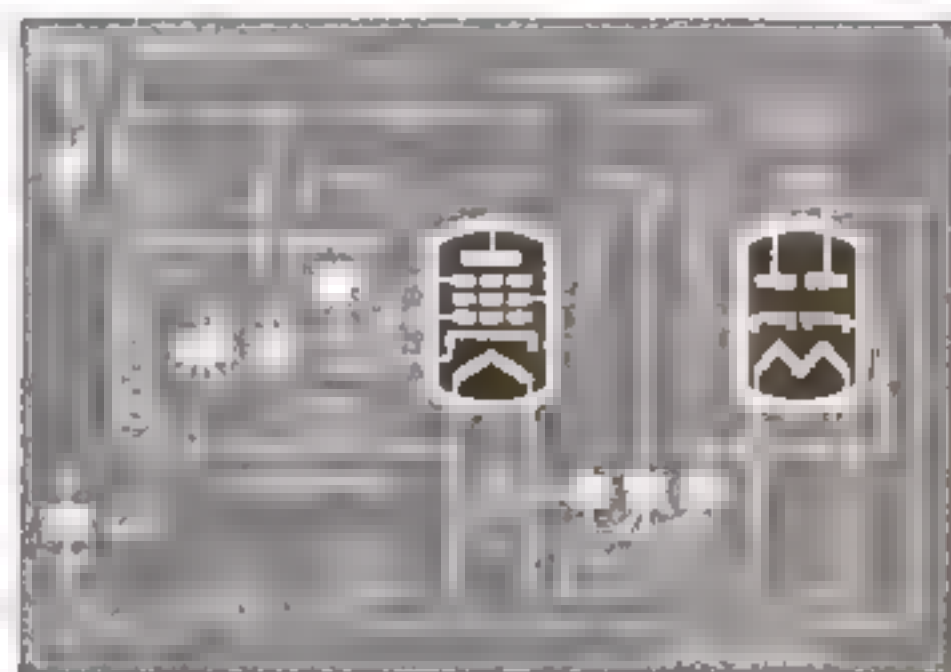
and the red one to the switch mounted on the front panel. Check this color code, however, as some manufacturers do not follow the standard coloring. Never disconnect the phones without first turning off the set, as plate voltage for the detector passes through them. It is also advisable always to have the regeneration condenser plates slightly in mesh, as the condenser helps to by-pass unwanted radio-frequency currents to the ground circuit.

LIST OF PARTS

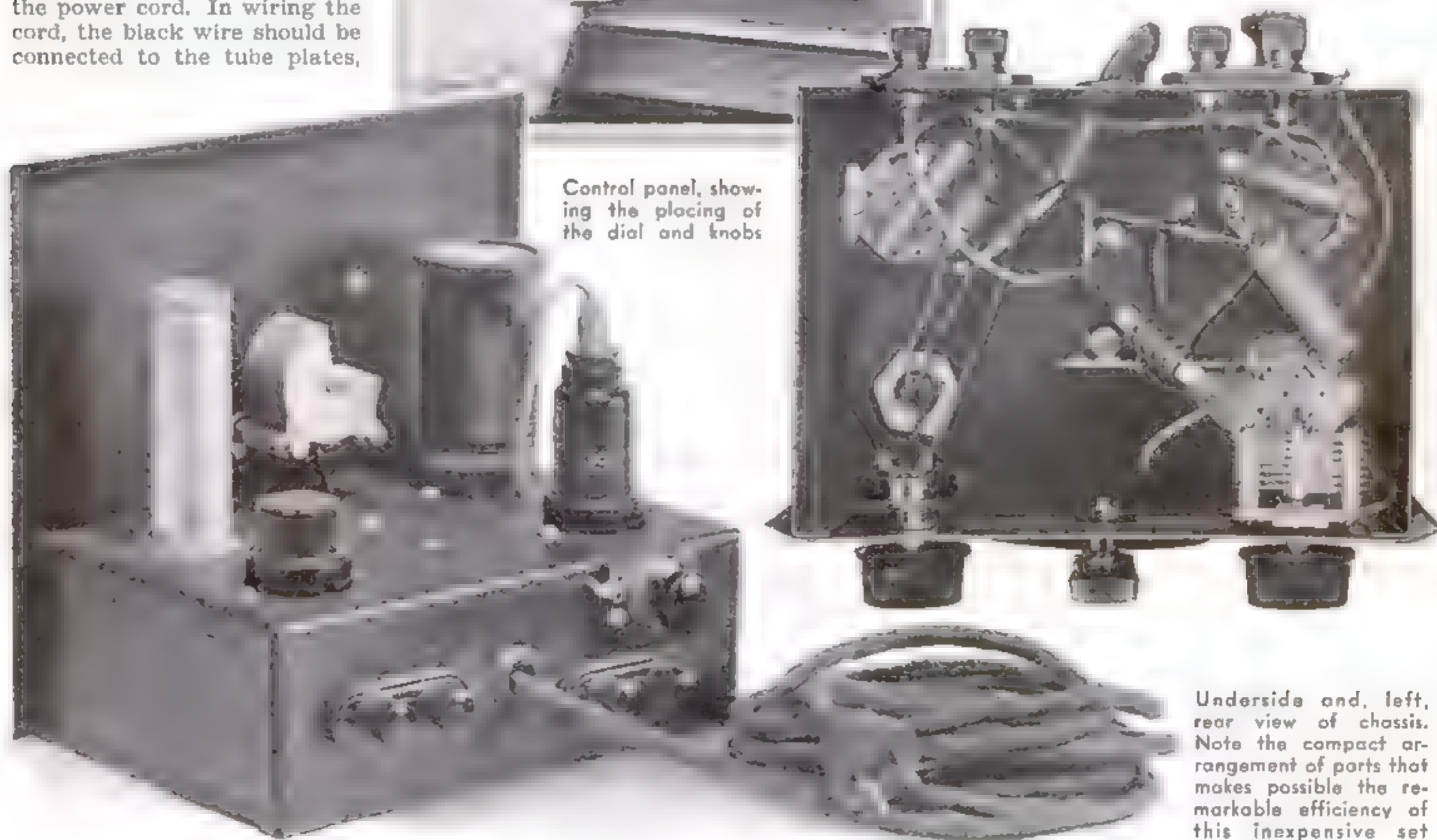
Tuning condenser, .00014 mfd.
Regeneration condenser, .0001 mfd.
Fixed condensers, .02 mfd. (tubular), .1 mfd. (tubular), and .0002 (mica).
Trimmer condenser, .00025 mfd.
Dual electrolytic condenser, 8 and 8 mfd.
Resistors, 3 megohm ($\frac{1}{2}$ watt), 1 megohm ($\frac{1}{2}$ watt), and 10,000 ohm (2 watt).
Radio-frequency choke, 25 mh.
Miscellaneous.—Power cord with 360-ohm resistor, sockets, tubes, plug-in coils (short wave, four-prong), switch, knobs, panel, chassis, dial, etc.



Control panel, showing the placing of the dial and knobs

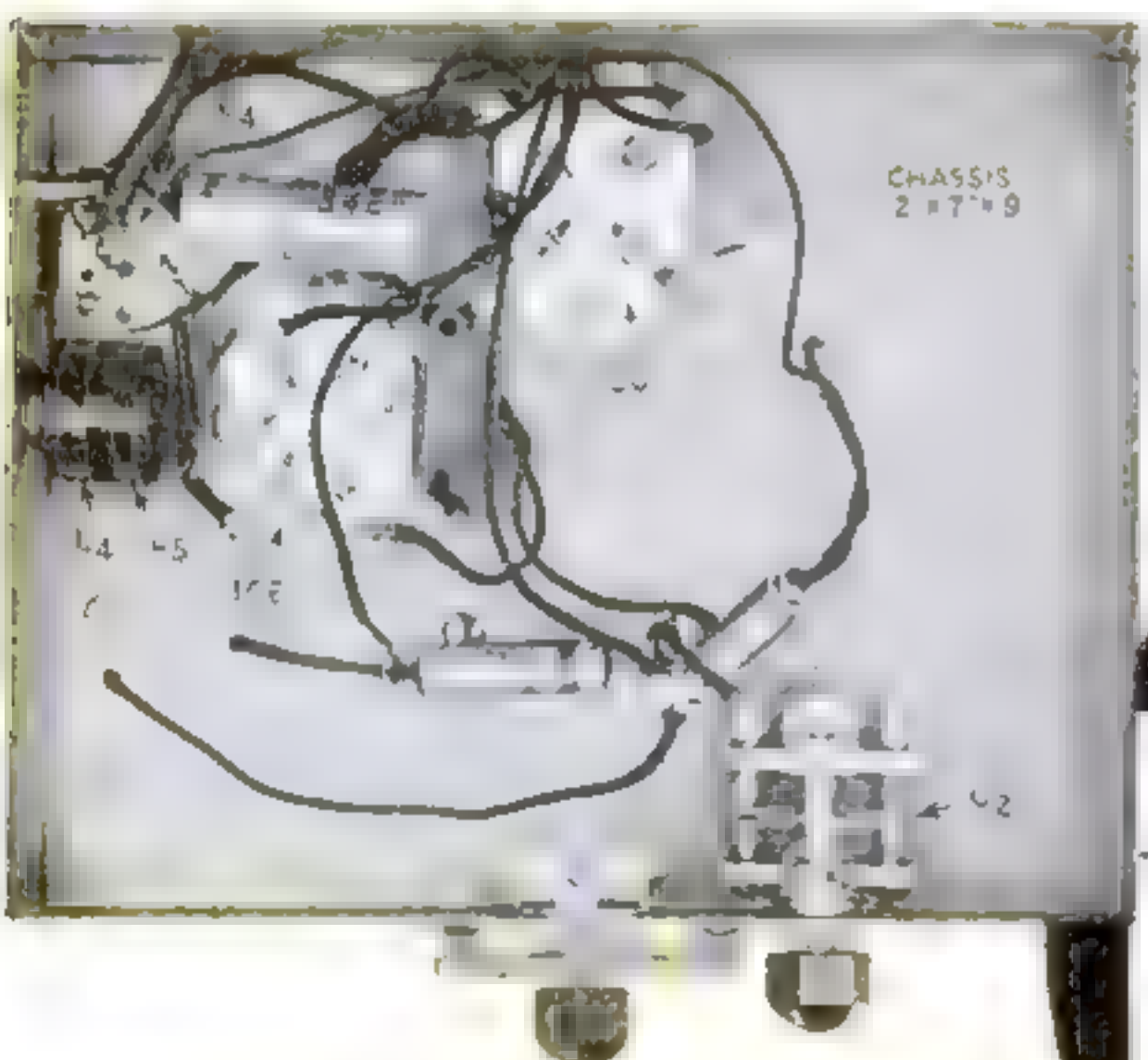
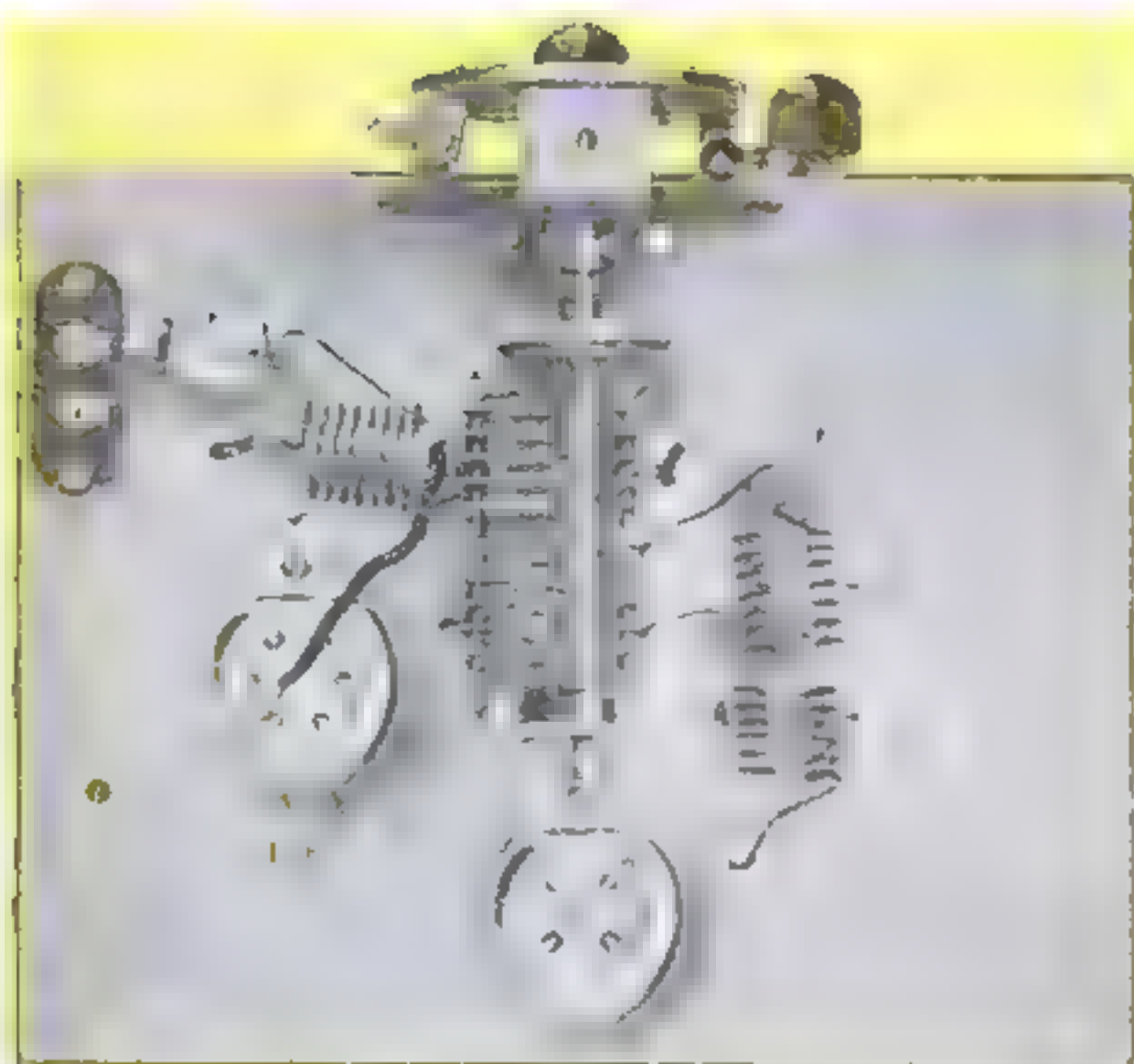


The 6H6 tube is wired to act as a rectifier



Underside and, left, rear view of chassis. Note the compact arrangement of parts that makes possible the remarkable efficiency of this inexpensive set

IMPROVE YOUR REGULAR SET WITH THIS Ten-Meter Converter



Top and bottom views of the chassis, showing how the various parts are arranged on its two faces

**Any Sensitive Receiver That Can
Tune Around 4,000 Kilocycles Will
Get Ultra-High-Frequency Stations
If Used with This Two-Volt Unit**

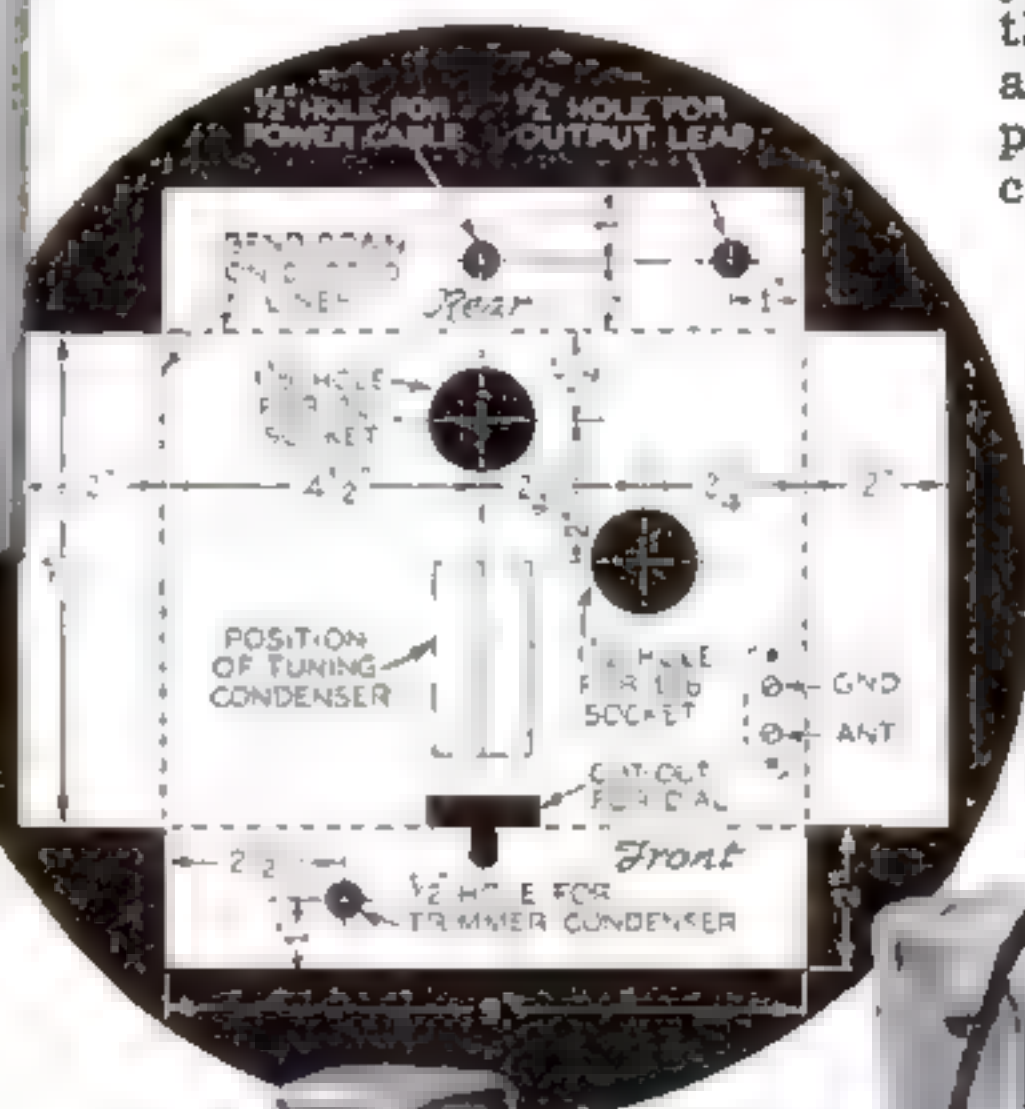
By
**HARRY D.
HOOTON**
W8KPX

WITH the growing popularity of the ultra-short-wave bands, more and more amateurs and short-wave listeners are regretting the fact that their regular sets are not constructed to tune down to ten meters. With the two-volt converter illustrated on these pages, however, any sensitive receiver capable of tuning in the vicinity of 4,000 kilocycles can be used to pull in the ultra-high-frequency stations in grand style. Connected to the receiver's antenna binding post, the two-tube circuit provides an auxiliary hook-up that will cover the entire twenty-eight-megacycle band.

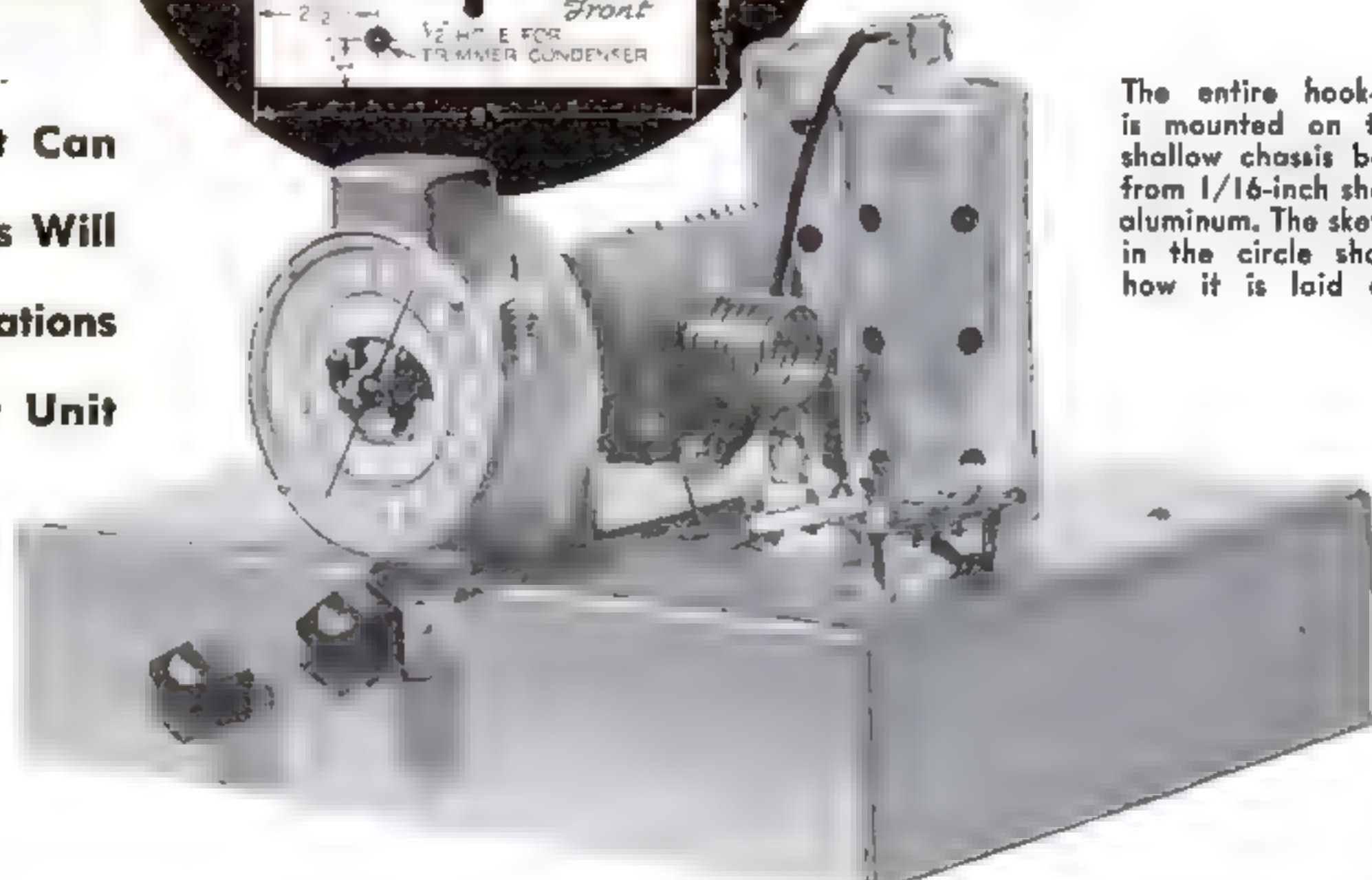
Although the actual construction and wiring are about as simple as any two-tube circuit, the work must be done slowly and carefully if good results are to be obtained. Using a scribe or other sharp-pointed instrument, lay out the various lines

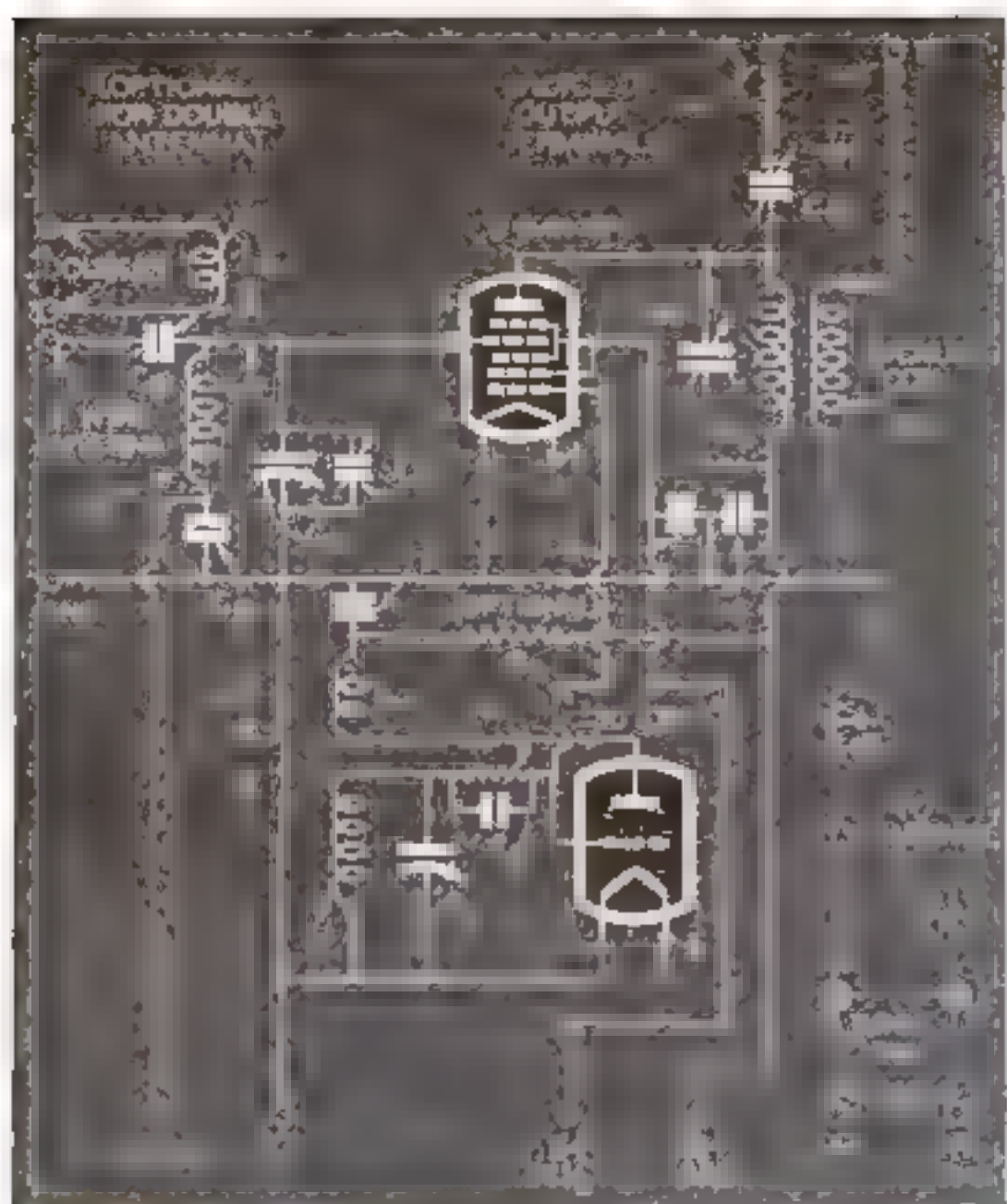
on the chassis as indicated in the sketch. Do not use a pencil for this purpose as the sharp point of the lead will soon wear away and a broad, indefinite line will result. Drill small holes at the intersection of the lines for starting the socket-hole punches. If punches are not available, the circumference of the holes may be drawn with a pair of dividers, and the metal reamed out and dressed down with a half-round file. There should be no deviation either from the layout shown or in the sizes specified for the parts. The specifications were chosen only after careful experiment had proved them to be the best for this particular circuit. The placement of the tuning condensers, the tube sockets, the coils, and the various resistors and by-pass condensers is clearly shown in the photographs.

In wiring the converter, keep the leads in all parts of the radio-frequency circuit as short and direct as possible and avoid making sharp bends or turns. Use either stranded or solid tinned copper wire having push-back insulation for making the connections, and try to bring as many of the negative leads as possible to a single spot on the chassis. This type of construction will minimize the noise and losses due to stray currents circulating in the metal of the chassis. Solder each joint carefully and use just enough solder to make a good electrical connection. The excess flux may be wiped away with a clean cloth or brush which



The entire hook-up is mounted on this shallow chassis bent from 1/16-inch sheet aluminum. The sketch in the circle shows how it is laid out





Assembling the circuit presents little difficulty

has been dipped in alcohol. The success of the unit will depend largely upon the care that you exercise in wiring and soldering the connections. Long leads or poorly soldered joints may result in a high noise level, low sensitivity, or a total lack of oscillation.

Before the converter is placed in operation, examine the input circuit of the receiver to be used, or refer to its diagram, in order to determine which method of coupling is most suitable. Some receivers are of the low-impedance input type; others may have high-impedance windings, capacity coupling, or both. If inductive coupling is to be used, the turns of the pick-up coil (L_5) should be proportioned to those on L_1 in the same ratio that the receiver antenna coil is proportioned to the grid

inductance of the first tuned circuit. The specifications, as given at the end of this article, will be suitable for most receivers with low-impedance windings. If the signals seem weak, it will be necessary to increase the turns on L_2 or couple the converter to the set through a small trimmer or padder condenser (C_{10}) of about fifty to 100 mmfd. maximum capacity. In this case, terminal A is used for the lead to the antenna post of the receiver. The converter and receiver ground leads should be connected together. Keep the radio-frequency lead from the output

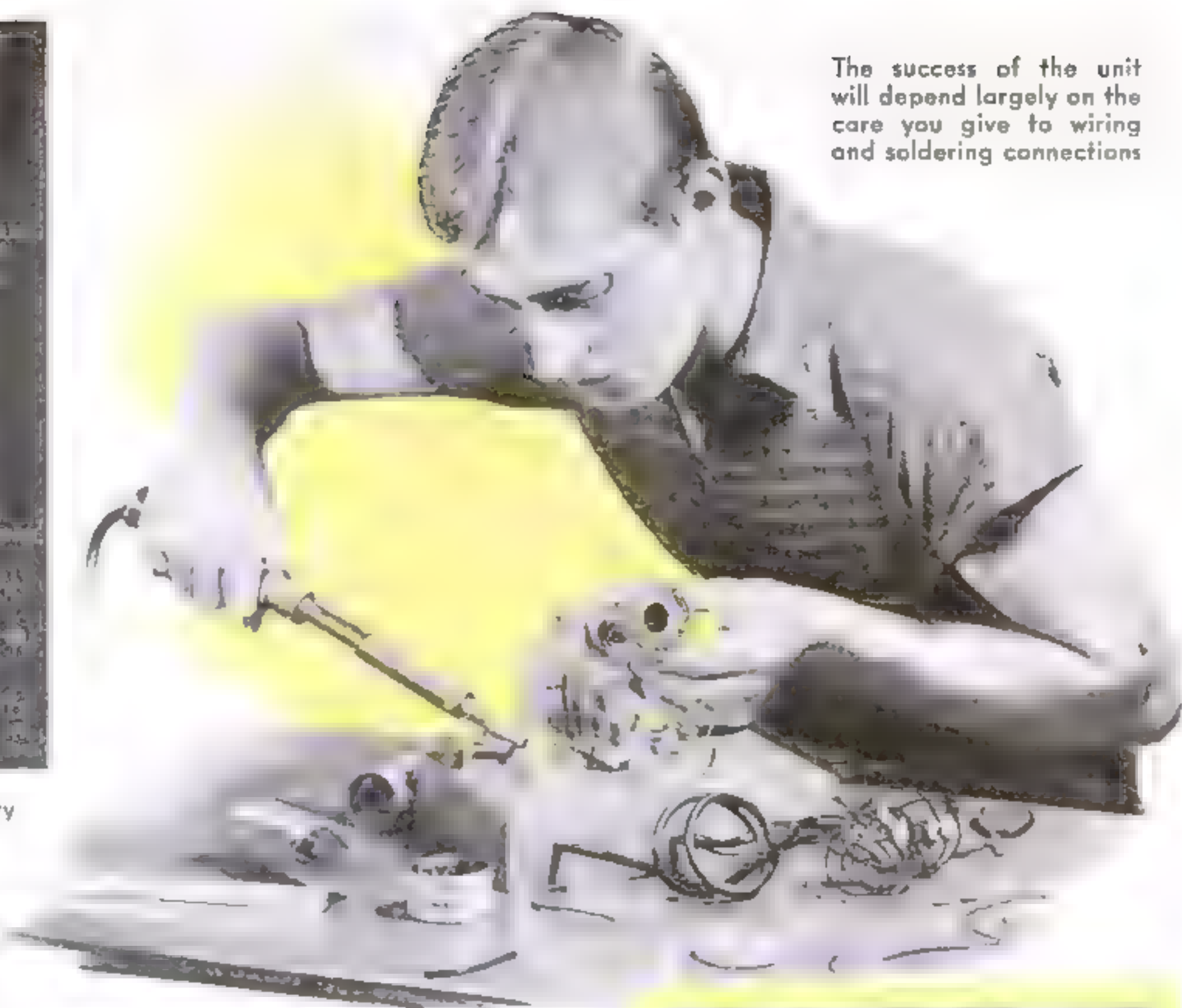
circuit of the converter (either A or B) to the antenna binding post on the receiver as short as circumstances will allow. If the receiver picks up stations operating on or near the frequency to which the converter is tuned, the lead will have to be shielded, preferably with one-half-inch woven copper tubing, which can be obtained from your parts-supply dealer.

With the converter connected to the receiver as outlined, close the battery switch and tune the receiver to some vacant spot outside the 3,500-kilocycle amateur band and adjust the condenser C_4 for maximum background noise. This noise should increase perceptibly as the condenser is adjusted. If it does not, the coupling will have to be revamped according to the instructions given in the preceding paragraph.

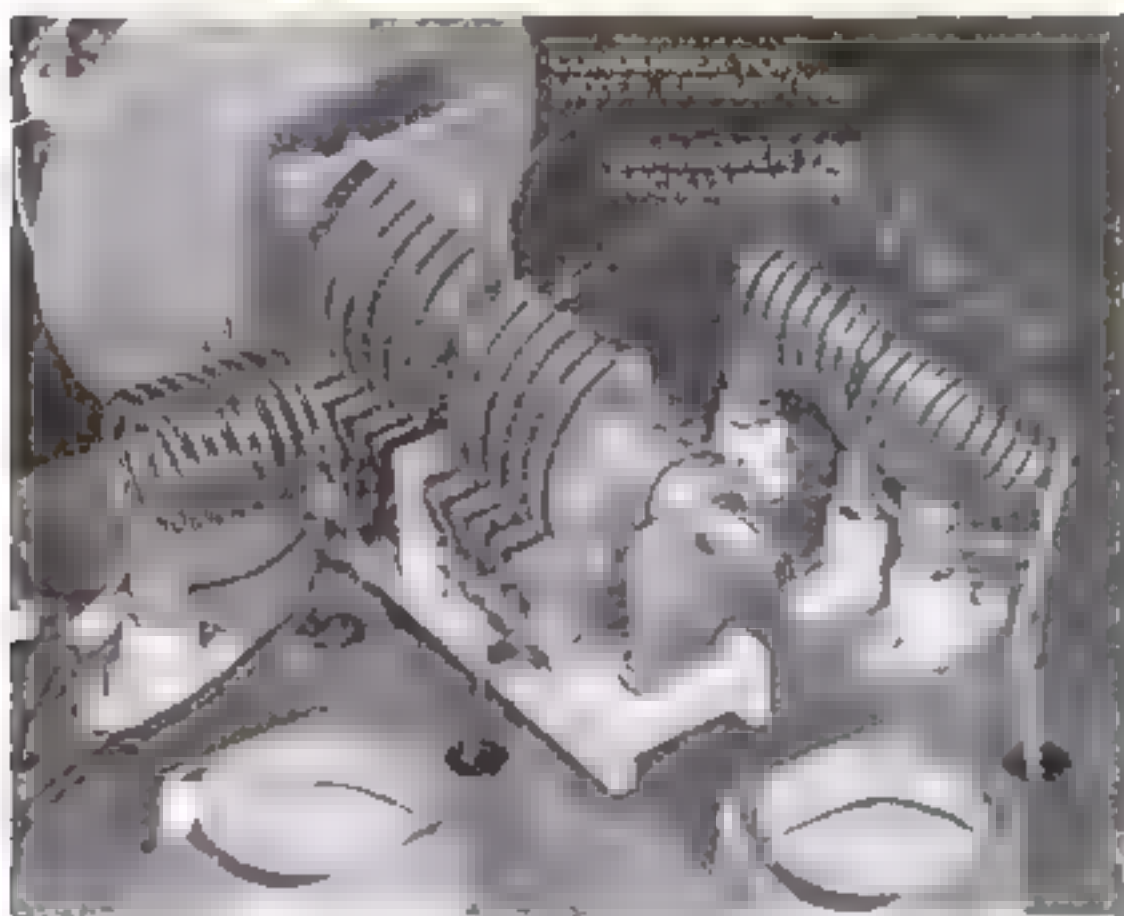
Once adequate coupling is obtained, the next step is to

(Continued on page 133)

The success of the unit will depend largely on the care you give to wiring and soldering connections



To cut down losses, all ground connections to the chassis should be made at one point



HOW COILS ARE MADE AND MOUNTED

Close-up view of coils. Winding specifications are:

- L_1 .—8 T. No. 14 enam. wire, $\frac{3}{4}$ -in. dia.
- L_2 .—6 $\frac{1}{4}$ T. No. 14 enam. wire, $\frac{3}{4}$ -in. dia.
- L_3 .—4 T. No. 20 enam. wire, $\frac{3}{4}$ -in. dia.
- L_4 .—20 T. No. 30 enam. wire, close-wound, 1 $\frac{1}{2}$ -in. dia.
- L_5 .—6 to 10 T. No. 30 enam. wire, close-wound, $\frac{1}{8}$ in. from plate end of L_4 .
- L_6 .—5 to 10 T. No. 20 enam. wire, $\frac{3}{4}$ -in. dia. Wound in opposite direction to L_4 .

LIST OF PARTS

- C_1 .—Tuning condenser, two-gang, 35 mmf. each section.
- C_2 .—Tuning condenser, midget, 20 mmf.
- C_3 .—Trimmer condenser, mica, 10 mmf.
- C_4 .—Trimmer or padder condenser, mica, 70 mmf.
- C_5 and C_6 .—Dielectric condensers, paper, 0.1 mfd., 400 volts.
- C_7 and C_8 .—Dielectric condenser, paper, 0.05 mfd., 400 volts.
- C_9 .—Fixed condenser, mica with wire leads, .0001 mfd.
- C_{10} .—Trimmer condenser, 50 to 100 mmfd.
- R_1 .—Carbon resistor, 50,000 ohms, $\frac{1}{2}$ watt.
- R_2 .—Wire-wound rheostat, 10 ohms.
- R_3 .—Carbon resistor, 20,000 ohms, 1 watt.
- L_1 , L_2 , L_3 , L_4 , L_5 , and L_6 .—Coils.

Miscellaneous.—Knobs, stand-off insulators, tubes, chassis, sockets, dial, switch, tube shields, etc.

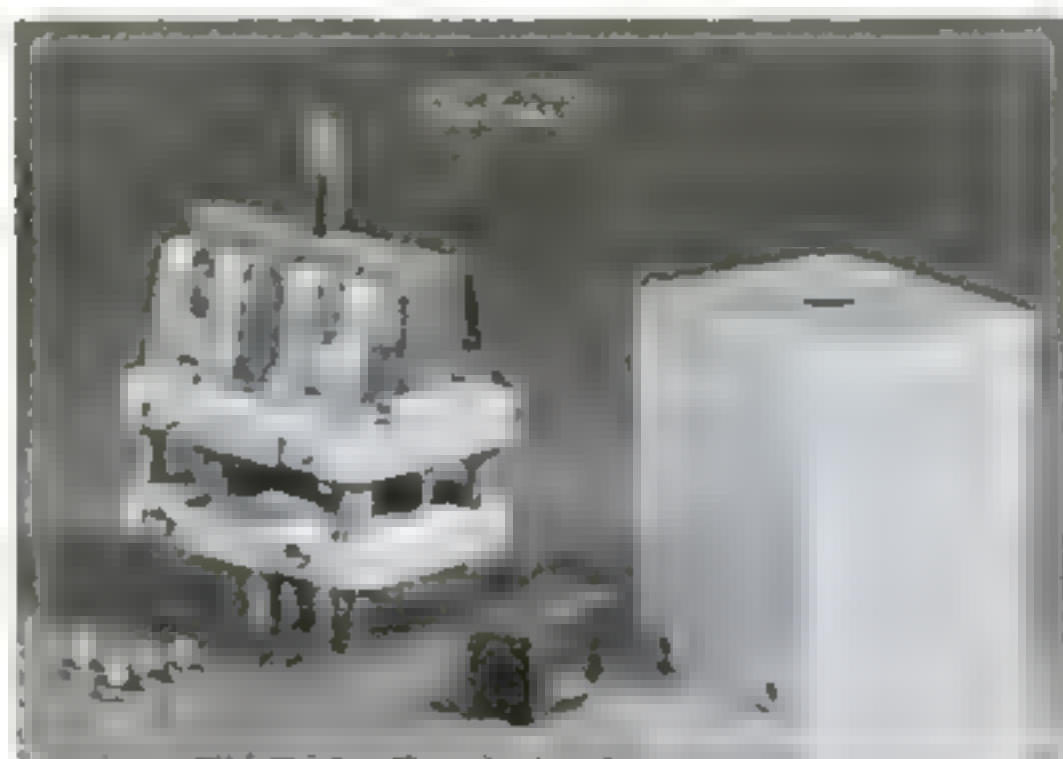


Speakers Get Neck-Type Mike

DESIGNED for public-address work, a tiny "rubber" microphone now on the market hangs on a leather strap around the user's neck. Although little larger than a box of safety matches, the compact unit houses a midget output transformer within its rubber case, and is said to pick up the speaker's voice regardless of the position of his head.

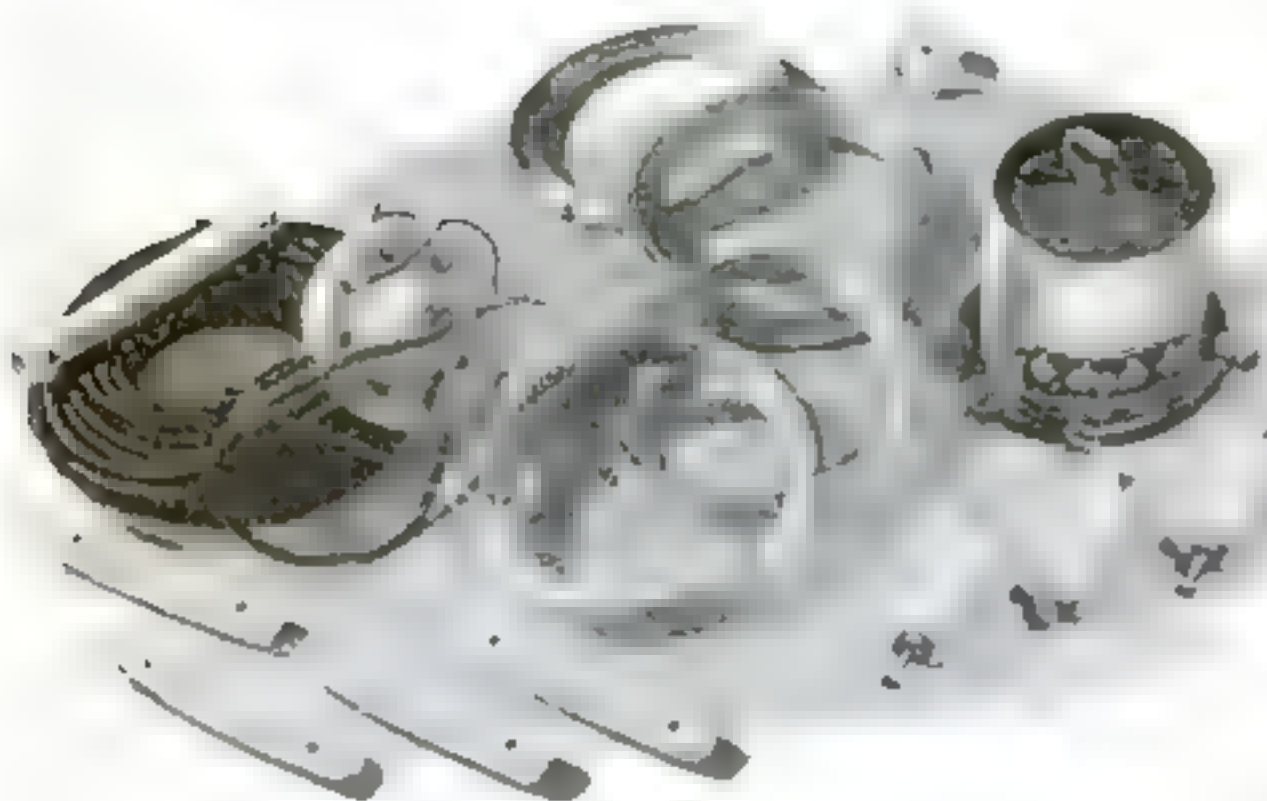
New Four-in-One Crystal Holder

ANY ONE of four crystals may be selected for use with a transmitter by turning the switch of a new crystal holder that does away with makeshift wiring and allows rapid frequency-band changing. For easy plug-in mounting, the holder is provided with tube-base prongs for making the necessary circuit connections.



The switch with housing removed to show crystal clips

Four-Wire Antenna Improves Reception



How the four-way antenna is wired. The complete kit of parts is shown at the left

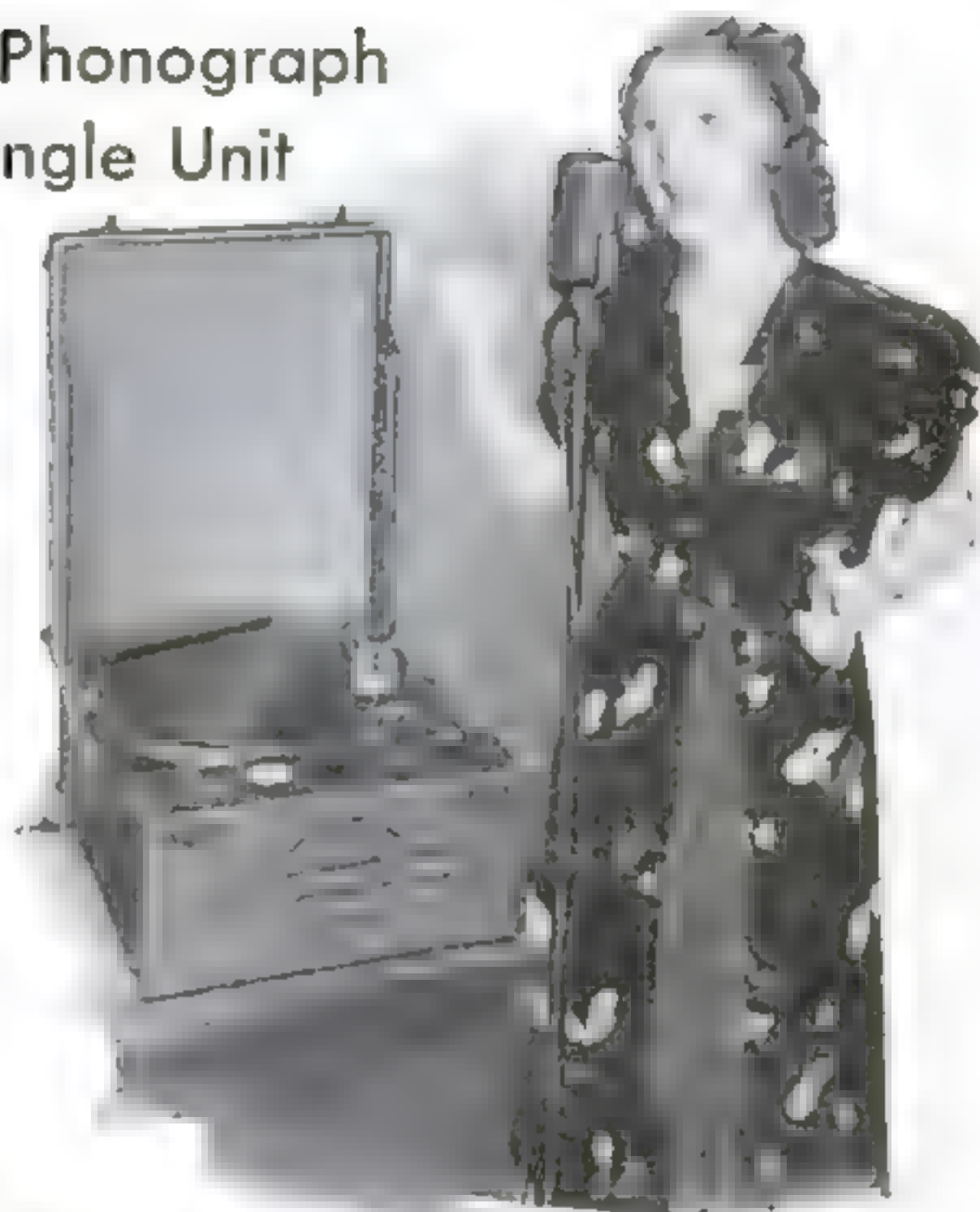
CONSISTING of four separate wires arranged like the spokes of a wheel and connected to a special selector switch, a new short-wave aerial system provides a choice of directional doublet antennas and makes it possible to obtain maximum signal strength from any point of the compass. To pick up signals

from the north, south, east, or west, either of the two doublets can be used; while intermediate directions are tuned by switching off one leg of each doublet, thus obtaining a directional effect at forty-five degrees. A special coupling transformer serves to match the transmission-line lead-in to the receiver input.

TIMELY HINTS FOR Radio Fans

Recorder and Phonograph Built in a Single Unit

RECORDING voices or music on special records that can be played back immediately without further processing, a new combination electric phonograph and recorder can be carried easily from place to place. Capable of producing noise-free records up to twelve inches in diameter, the unit provides a convenient means for making sound records for home movies and recording radio programs. It is entirely portable.



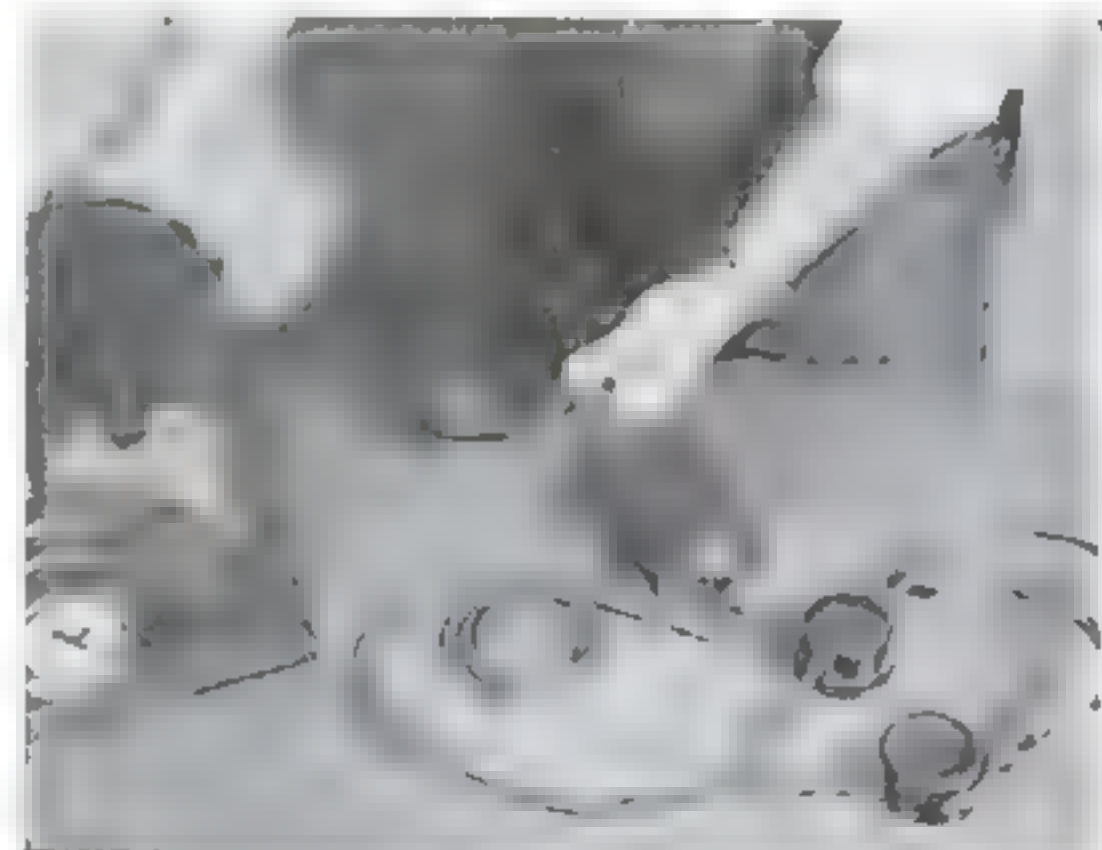
This compact recorder can be set up in five minutes

Rubber Testing Mallet

USED instead of a screw-driver handle or other tool that might cause damage, a rubber-headed mallet now available is a handy tool for tapping a receiver chassis to locate noises and loose connections.

Earphone Attachment for Modern Receiving Sets

EASILY installed, the universal adapter shown below makes it possible to use headphones with any modern loudspeaker set. Designed to aid the radio fan who desires to listen to programs without disturbing the rest of the household, the auxiliary unit does not interfere with the regular operation of the set, and may be operated independently or in conjunction with the loudspeaker, as desired. No tools are needed for installing.



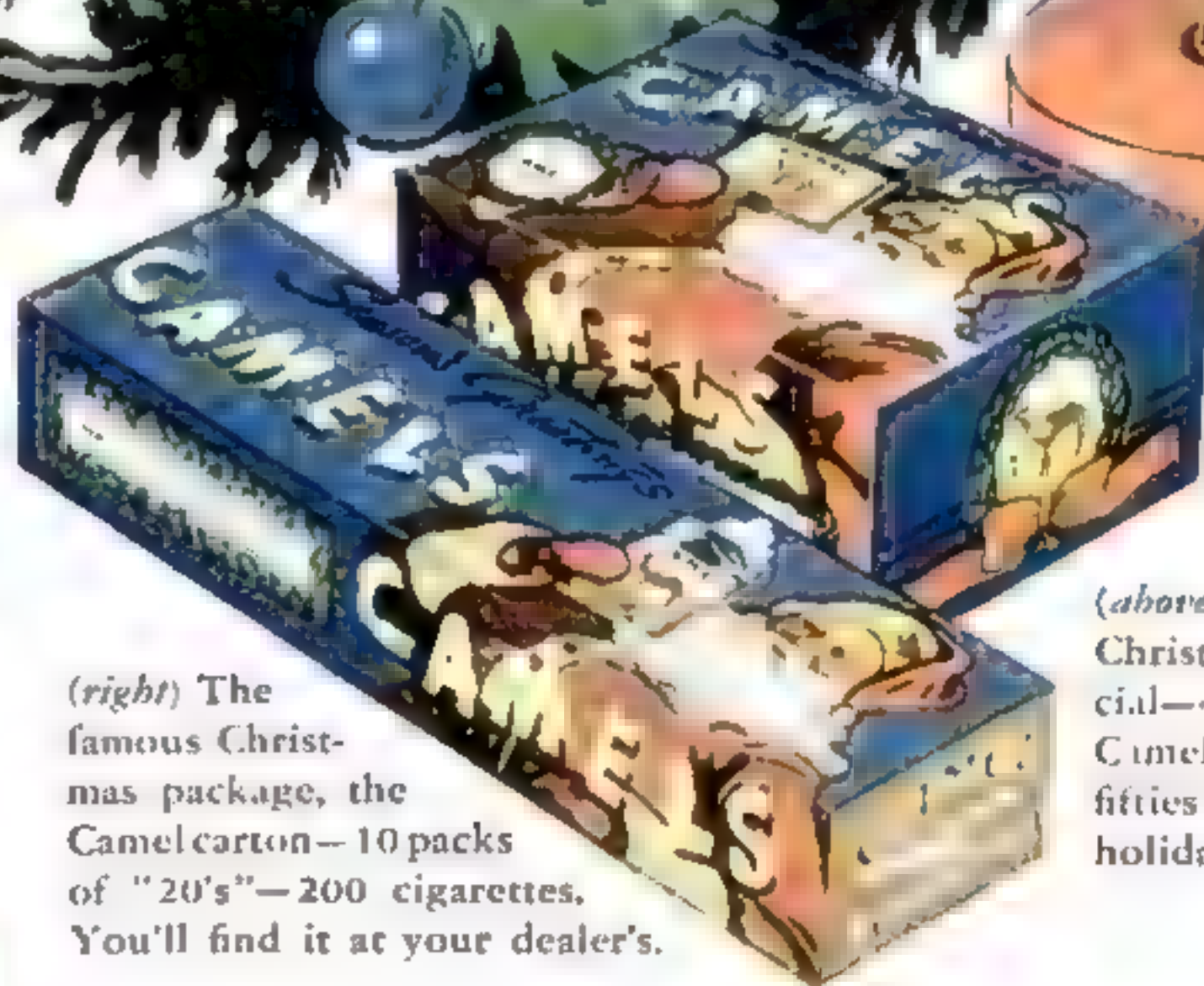
The adapter attached to a broadcast receiver



Camels

MADE FROM FINER,
MORE EXPENSIVE TOBACCOS

Give Camels for Christmas! There's no doubt about how much people appreciate Camels—the cigarette that's made from finer, MORE EXPENSIVE TOBACCOS. A gift of Camels says: "Happy Holidays and Happy Smoking!"



(right) The famous Christmas package, the Camel carton—10 packs of "20's"—200 cigarettes. You'll find it at your dealer's.

(above) Another Christmas special—4 boxes of Camels in "flar fitties"—in gay holiday dress.

(right) A pound of Prince Albert in a real glass humidor that keeps the tobacco in prime condition and becomes a welcome possession.



(left) One pound of Prince Albert—the "biteless" tobacco—in an attractive Christmas gift package.

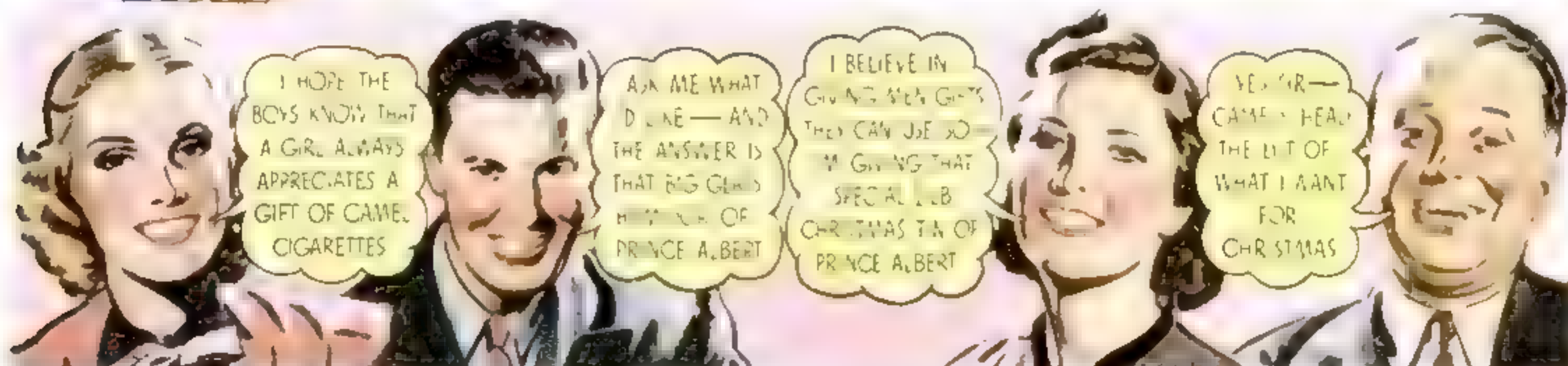


Prince Albert

THE NATIONAL JOY SMOKE

If you know a man owns a pipe—you're practically certain to be right if you give him PRINCE ALBERT—The National Joy Smoke. Beginners like P.A. because it doesn't bite. Occasional pipe-smokers find it's extra cool. And the regulars think it's tops for mellow taste.

Copyright, 1937, R. J. Reynolds Tobacco Company, Winston-Salem, North Carolina



I HOPE THE BOYS KNOW THAT A GIRL ALWAYS APPRECIATES A GIFT OF CAMEL CIGARETTES

ASK ME WHAT I LIKE — AND THE ANSWER IS THAT BIG GUY'S HUMIDOR OF PRINCE ALBERT

I BELIEVE IN GIVING MEN GIFTS THEY CAN USE SO I'M GIVING THAT SPECIAL LUB CHRISTMAS TIN OF PRINCE ALBERT

YES SIR — CAMEL'S HEAD THE LIST OF WHAT I WANT FOR CHRISTMAS

Darkroom Timer

MADE FROM OLD ALARM CLOCK

IF YOU develop your own films, you can reconstruct an old alarm clock into a serviceable timer.

Remove the works from the case and discard the hour hand and the two wheels that actuate it. Then build a box of thin wood with a piece $\frac{1}{4}$ in. thick at the base for mounting the works. The box should be as deep as the works are, measured from plate to plate. For mounting the clock, use two metal strips as shown. A hole is cut in the top of the box for the balance wheel. This is done so the clock can be stopped and started by touching the balance wheel.

Make a front for the box out of cardboard. Locate the hole for the minute-hand shaft and drill a $\frac{1}{4}$ -in. hole.

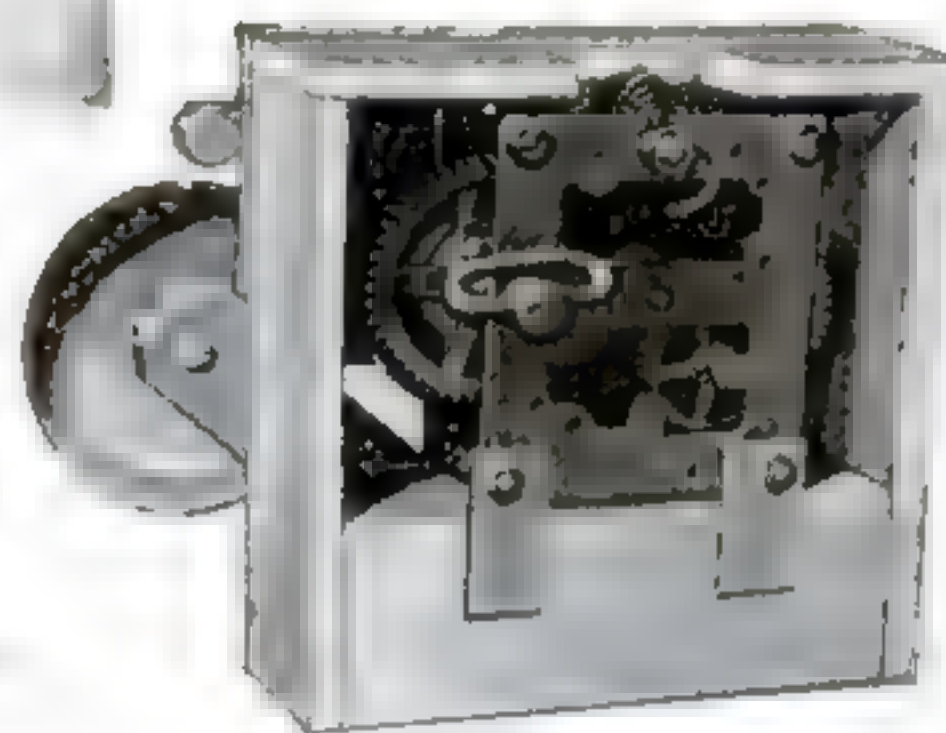
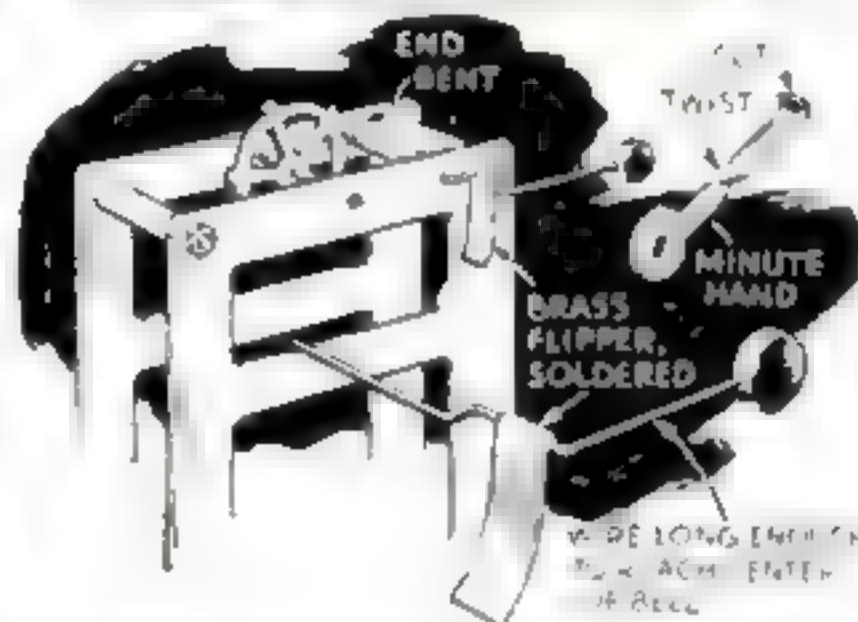
Cut a pie-shaped piece out of the old dial and mount it on the front board, using the center hole of the old dial as a guide. Take the old minute hand, cut it off, making it about 1 in. long, and bend it as in the drawing. Make a new minute hand of brass long enough to reach from the shaft to the rim of the dial. This should be bent out as shown in one of the photos so it won't hit the bell-hammer lever.

The bell-hammer lever is made from a piece of wire the same size as the old one. You will probably find holes in the plates of the works at the top where you can mount this. If not, drill the necessary holes.

Cut a piece of thin wood or metal about 2 in. long by $\frac{1}{2}$ in. wide and mount the bell on this in a position where it will not interfere with the hands. Make a long slot in the top of the front board to allow free (Continued on page 108)

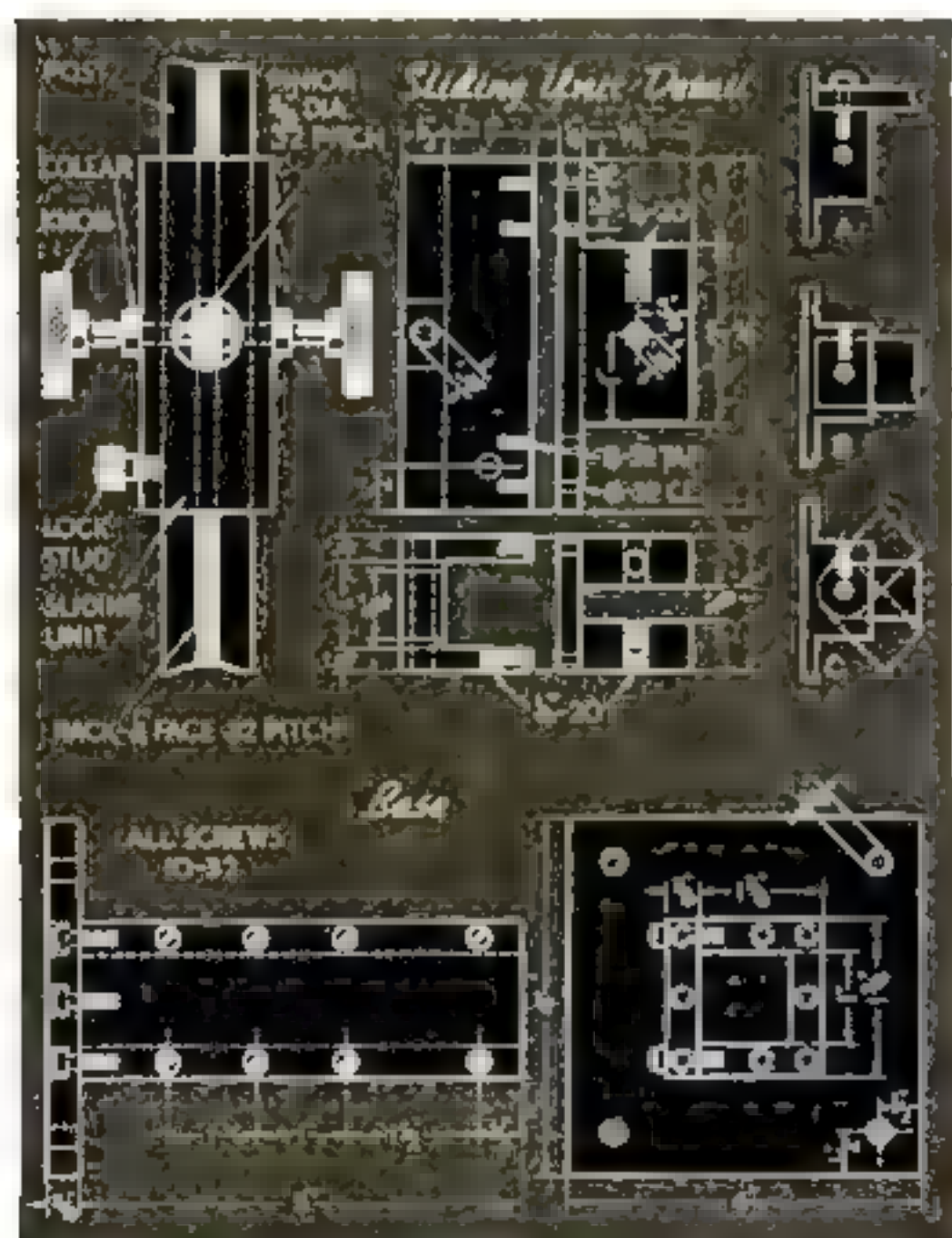


The minute hand is turned to the required number of minutes by means of the setting knob, and the clock started by touching the balance wheel. Left above is the front view, and at left, the bell-ringing device



How the bell lever and operating hand are made, and a rear view of the timer

All-Purpose Adjustable Stand for Photographers



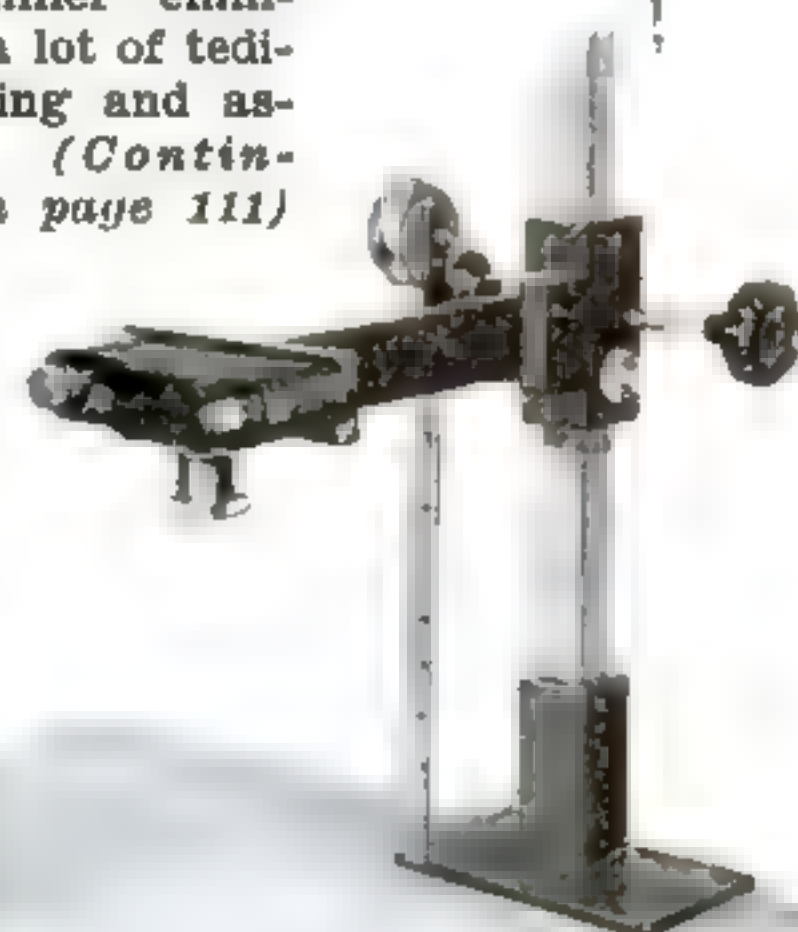
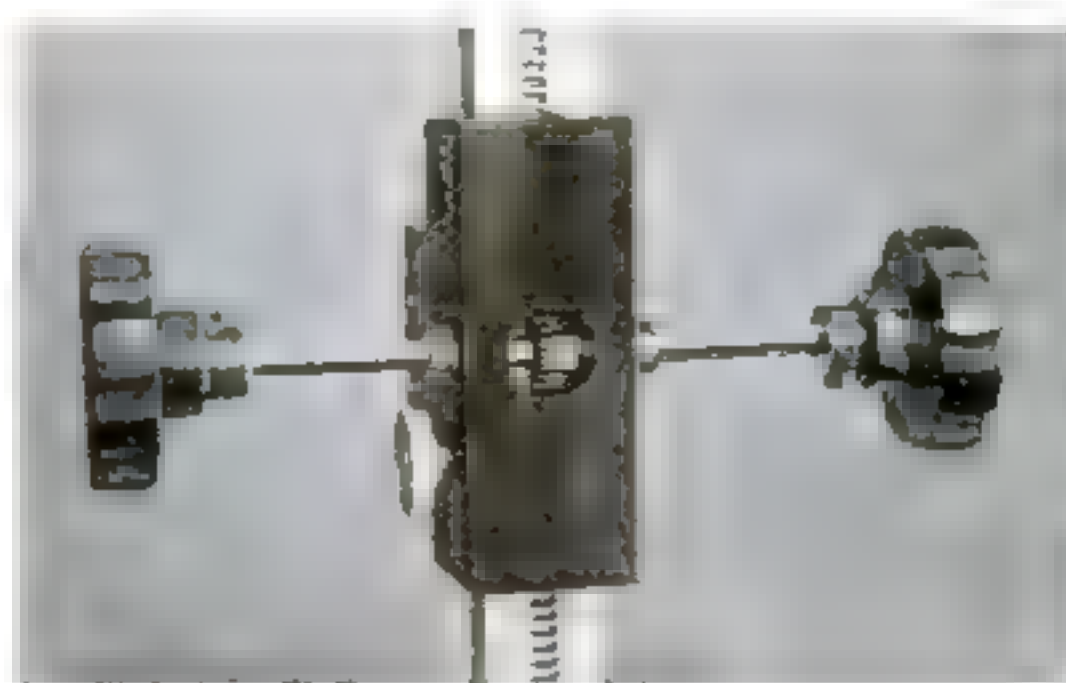
Construction of stand and three ways to fasten on the arm. At right, a back view showing rack and pinion. Extreme right, set-up for copying with miniature camera

THIS adjustable upright stand solves many problems for the amateur photographer. It will support a miniature camera, a view camera, or even a heavy reflecting type camera when used for copying, microphotography, or macrophotography. An enlarger can be mounted on it for either horizontal or vertical projection. In addition, it is useful as a general laboratory stand.

Among other advantages are the comparatively simple construction, the strength and ease of adjustments, and the absence of any tendency to sway. Small vibrations are quickly

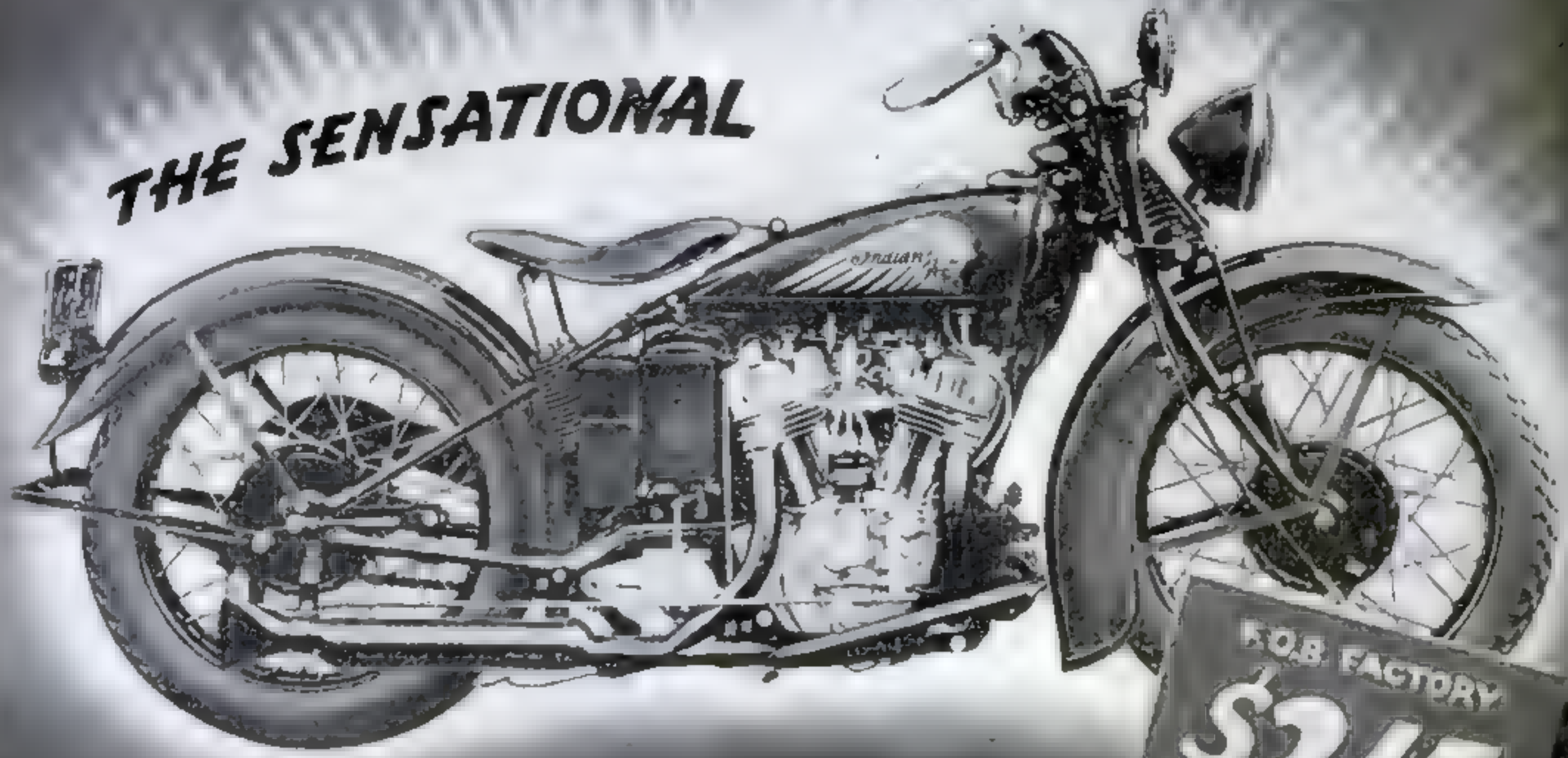
damped out because of its rigidity.

Once the materials have been obtained, the stand may be built in a few hours by using for the most part two tools—a milling machine and a drill. The miller eliminates a lot of tedious filing and assures (Continued on page 111)



NEW 1938 MODELS

THE SENSATIONAL



Indian JUNIOR SCOUT



THE TWIN CYLINDER MOTORCYCLE MARVEL

THE NEW 1938 INDIANS ARE READY to flash you over the open road to fun and adventure! New Indian triumphs, all of them—great motorcycles built as only Indian can build them.

Heading the parade is the new Indian Junior Scout—the greatest twin cylinder "buy" in all motorcycle-dom! It's a great machine—an engineering marvel easy to handle, easy to start, with plenty of power and pep to flash you along with the leaders. And it costs so little to run—you'll get 70 miles to the gallon easily!

NOW OWN AN INDIAN ON EASY PAYMENTS

The Junior Scout is still the lowest priced "twin" in America! So why wait? Visit your Indian dealer today and let him tell you how easy it is to own any Indian model on easy payments.

3 OTHER '38 MODELS

DELUXE 4—the only four cylinder motorcycle made in America—quiet, smooth, comfortable.

CHIEF 74—for the rider who places a premium on "top speed" and performance.

SPORT SCOUT—a racing model for the man who wants to be a winner in sporting events, an easy-to-handle machine that's "out in front" always.

BOY—HOW THEY TRAVEL!



Don't forget our great FREE OFFER



Get this fine RIDER'S HELMET and INDIAN PIN absolutely FREE when you place your order.

MAIL COUPON TODAY!

INDIAN MOTORCYCLE CO., Springfield, Mass.
Please send me at once, without obligation, your illustrated Folder showing the new 1938 Indian Motorcycles, and CERTIFICATE of VALUE entitling me to FREE RIDER'S HELMET and INDIAN PIN, as illustrated, when I place my order.

Name.....

Address.....

Please be sure to check your age group: PSM 1
☐ 16-19 years ☐ 20-30 years ☐ 31 years and up ☐ under 16 years

INDIAN MOTORCYCLE CO., Springfield, Mass.

How to Load Bulk Film for Miniature Camera

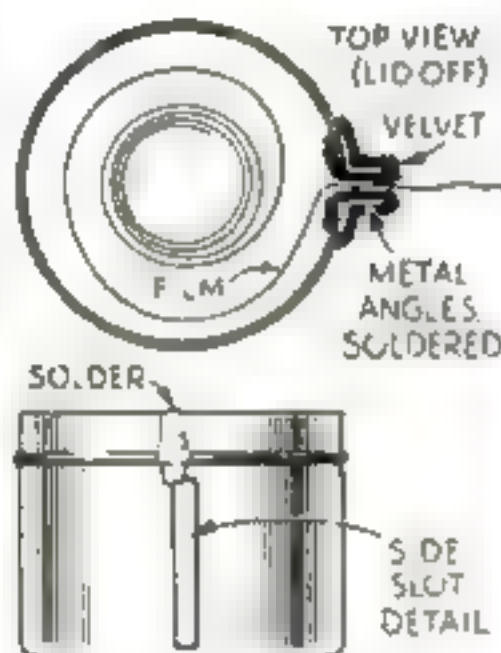
ALTHOUGH most miniature-camera owners are aware that it is possible to save on their film costs by using bulk film, many hesitate because modern high-speed films make it necessary to do the loading in complete darkness. With this simple light-trap can, the most difficult part of the job—that of tonguing the film, starting it on the



A light trap in the loader enables the film to be started on the spool in subdued light

spool, and reassembling the film cartridge—can be done in subdued light. Once this is done, the light is switched off and in complete darkness the desired length of film is wound into the cartridge by rotating the spool.

The loading can consists of an old film container fitted with two metal lips lined with black velvet to form a light trap. The roll of unexposed film is placed inside the can, and one end is pushed through the trap. To protect the film, the whole assembly should be stored in a larger metal can fitted with a tight cover.—STANLEY JOHNSON.



Lips are added to an old film container

Simple Darkroom Timer

(Continued from page 106)

movement of the bell hammer. Mount the front board in place and attach a piece of spring wire in the upper right-hand corner, adjusting it so that the bell hammer doesn't quite touch the bell. Then mount the hands as shown and place the old setting knob in front.

Turn the hands until the short hand just releases the bell hammer. Now adjust the long hand to point to X. Turn the hands so the long one is at IX, start the clock, and the bell will ring in five minutes. After you have made the necessary adjustments, force the hands on tight.

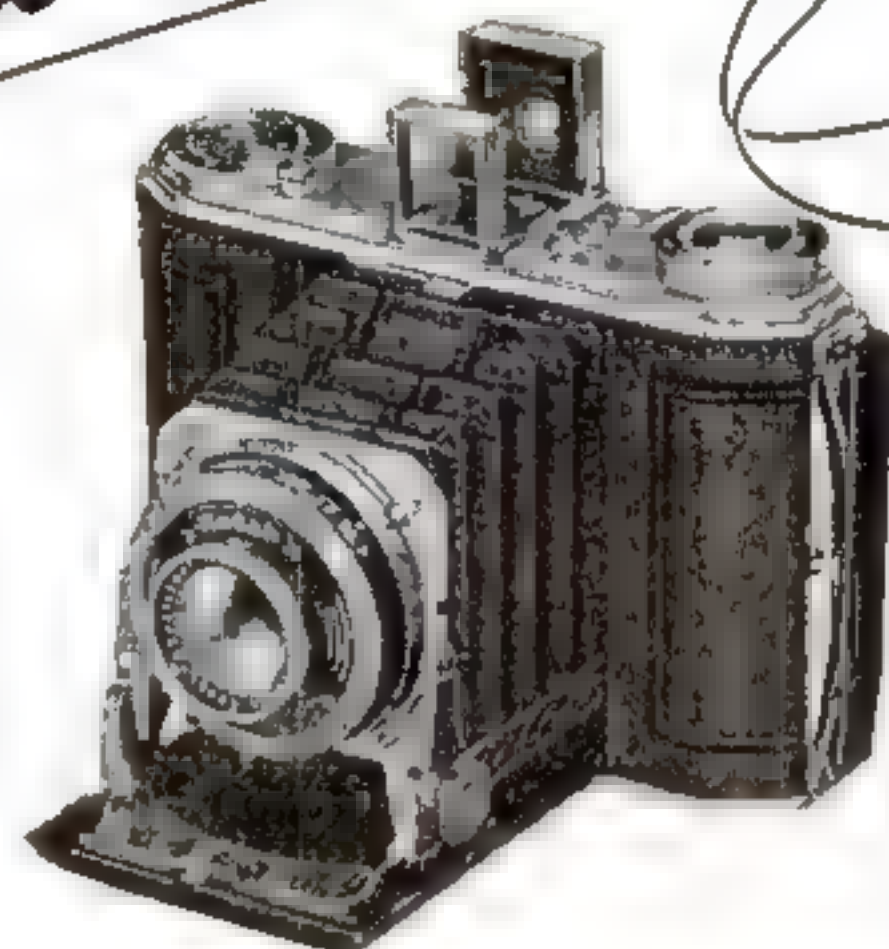
To use, stop the clock by touching the balance wheel with a finger and set the minute hand on the required minute mark, from one to ten. When you have your film ready to develop, start the clock and develop till the bell rings.—C. R. EMERY.

PREVIEW of

Miniature Kodaks

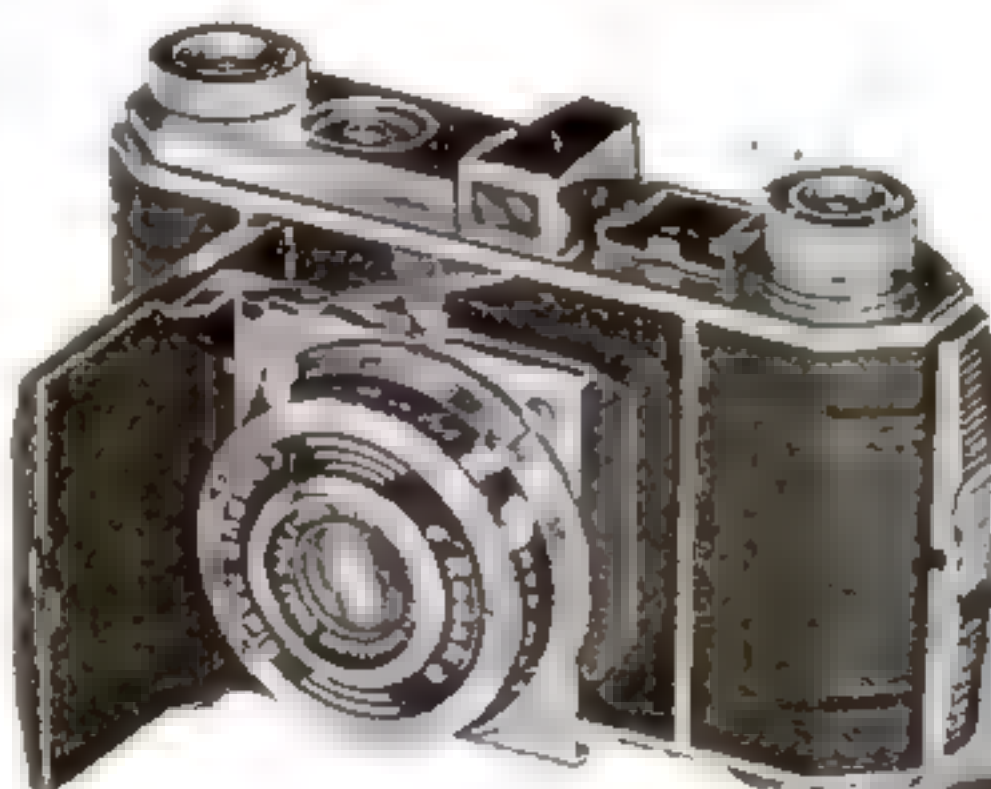
KODAK DUO SIX-20, SERIES II

(right) New, improved—the "miniature" that takes album-size pictures (1½x2¼ inches). Lens, Kodak Anastigmat f.3.5; shutter, 1/500-second Compur-Rapid. New features include handy plunger-type shutter release on camera body (minimizes camera movement when making exposures); bracket for Kodak Pocket Range Finder; single-finger bed release for easy closing; die-cast metal body, beautifully covered, satin-chrome trimmed. Price remains **\$57.50**



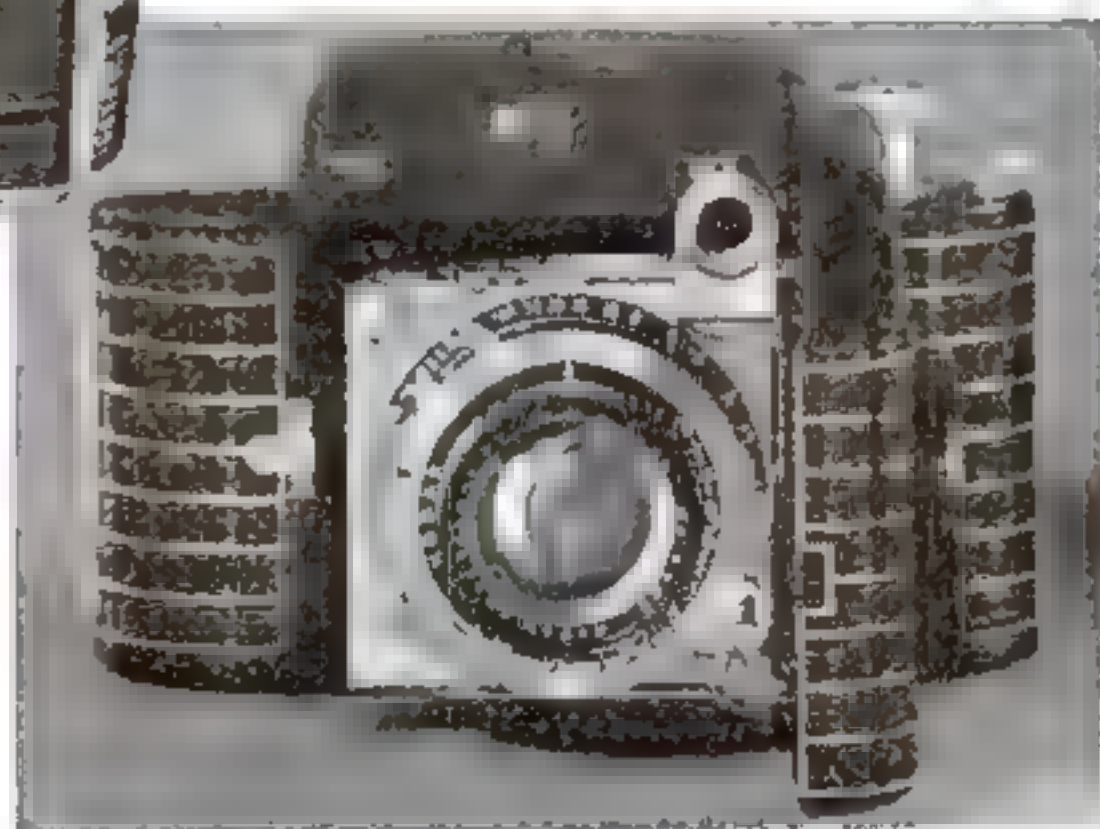
KODAK BANTAM SPECIAL

(below) Performs brilliantly in any weather, under all conditions. Lens, Kodak Anastigmat EKTAR f.2.0. 1/500-second Compur-Rapid shutter. Coupled range finder, military-type, split-field. Film-centering device. Negatives are needle-sharp, yield superb enlargements (standard low-cost size, 2¼x4 in.). Also makes full-color transparencies on Kodachrome Film. Price **\$110**



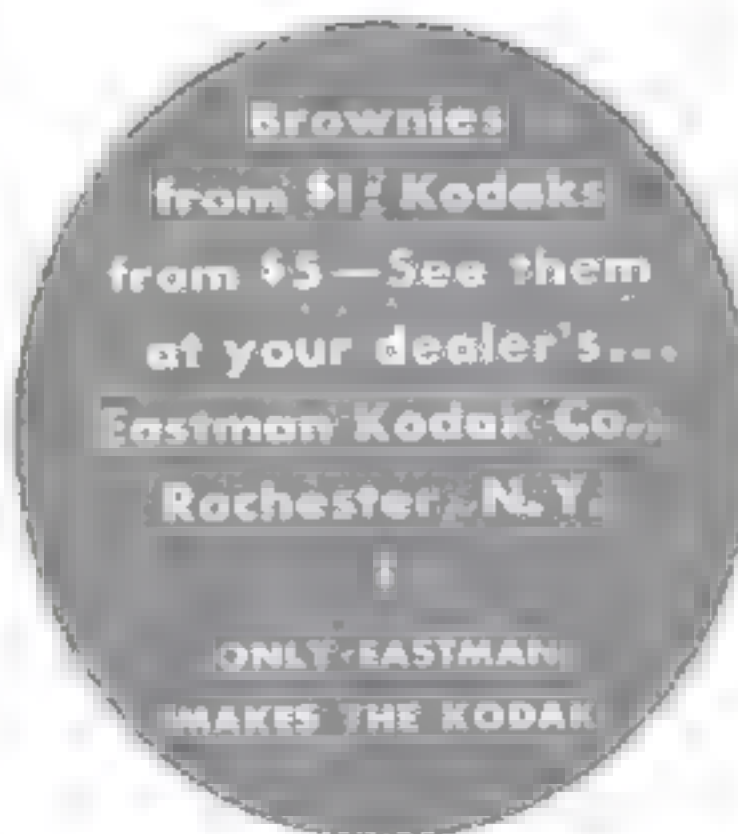
KODAK RETINA

(above) Equipped with new super lens, Kodak Anastigmat EKTAR f.3.5. 1/500-second Compur-Rapid shutter. For black-and-white pictures capable of extreme enlargement: Kodak "SS," Panatomic, Super X, Infra-Red Film. For full-color transparencies: Kodachrome Film. (Negative size approximately 1 x 1½ inches.) Film-measuring device. Exposure counter. Price **\$57.50**



KODACHROME FILM FOR FULL-COLOR "STILLS"

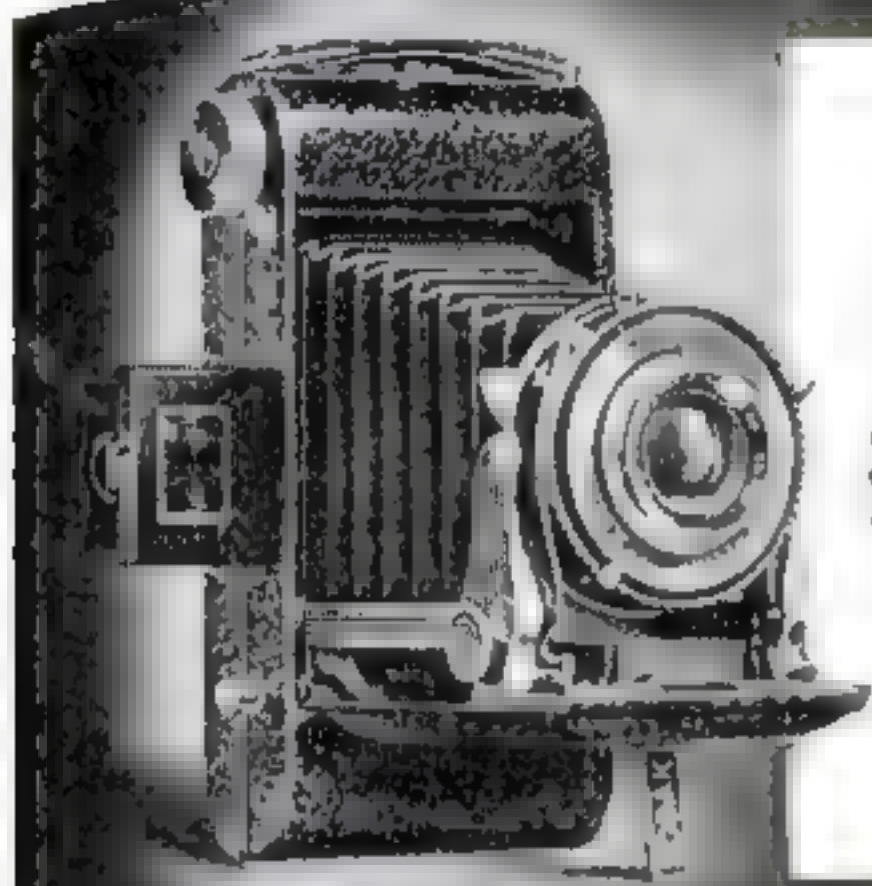
Load with Kodachrome Film, and you get gorgeous full-color transparencies that may be viewed as they are, or mounted in slides for large-size projection on the home screen, in the Kodaslide Projector. Easy to make as black-and-white. No extra equipment is required for taking all ordinary shots; the color is in the film itself. No. K828 or K828A (8 exposures) for Kodak Bantam Special, \$1.35; No. K135 or K135A (18 exposures) for Kodak Retina and similar cameras, \$2.50. Prices include processing.



your Kodak dealer's Christmas suggestions....

Precision Kodaks

Ciné-Kodaks



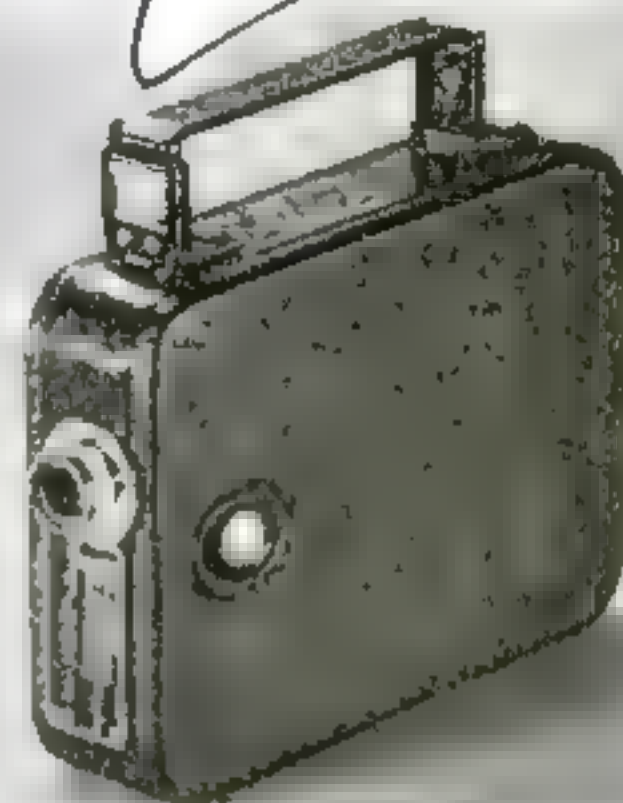
KODAK SENIOR SIX-20 (f.4.5)

Combination of body shutter release and eye-level finder offers new picture-making certainty... minimizes camera movement, catches the scene when it's exactly right.

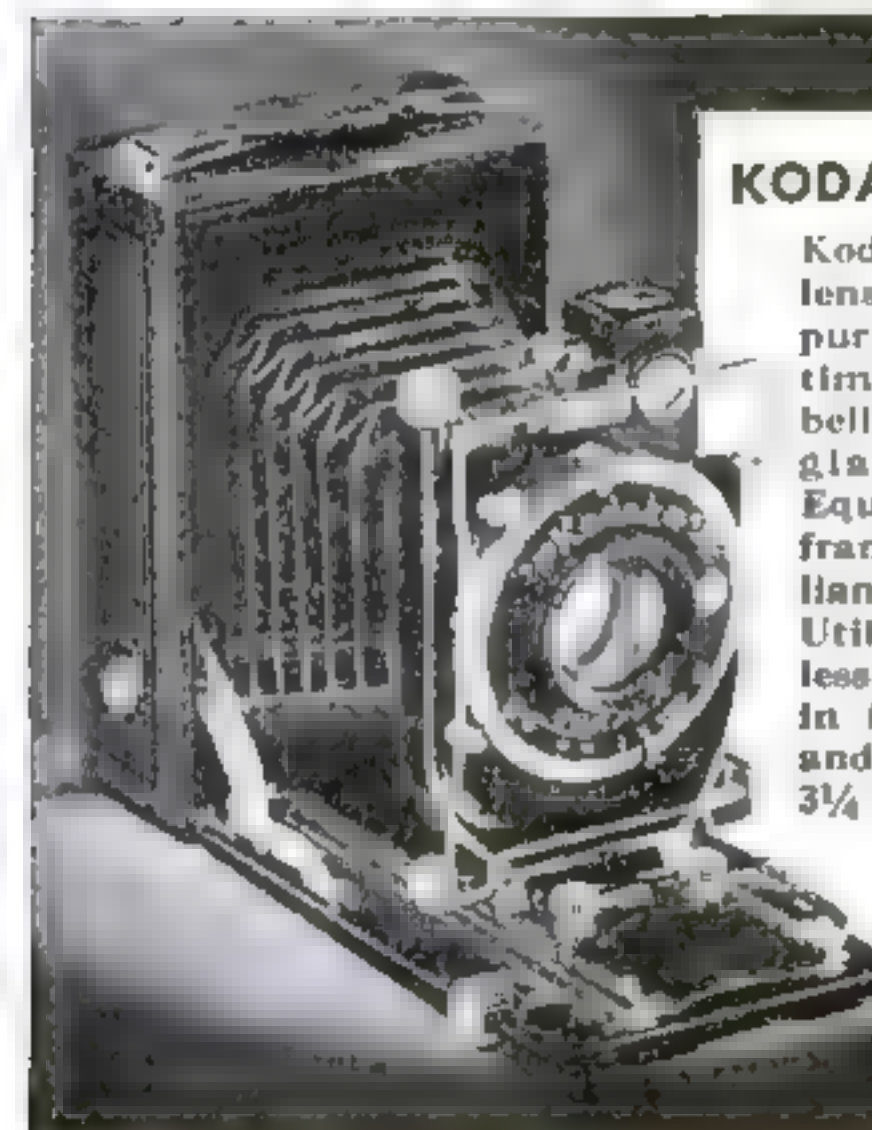
Kodak Anastigmat f.4.5 lens; 1/200 Kodamatic shutter. One-finger bed release. 2 1/4 x 3 1/4-inch pictures. Price **\$29.50**

CINÉ-KODAK EIGHT

Movies at "10 cents a shot." The "Eight" makes it possible. A roll of Ciné-Kodak Eight Panchromatic Film costs only \$2.25, black-and-white, finished, ready to show. Yet it runs as long on the screen as 100 feet of amateur standard home movie film—gives you 20 to 30 movie scenes of news-reel length. Price **\$34.50**

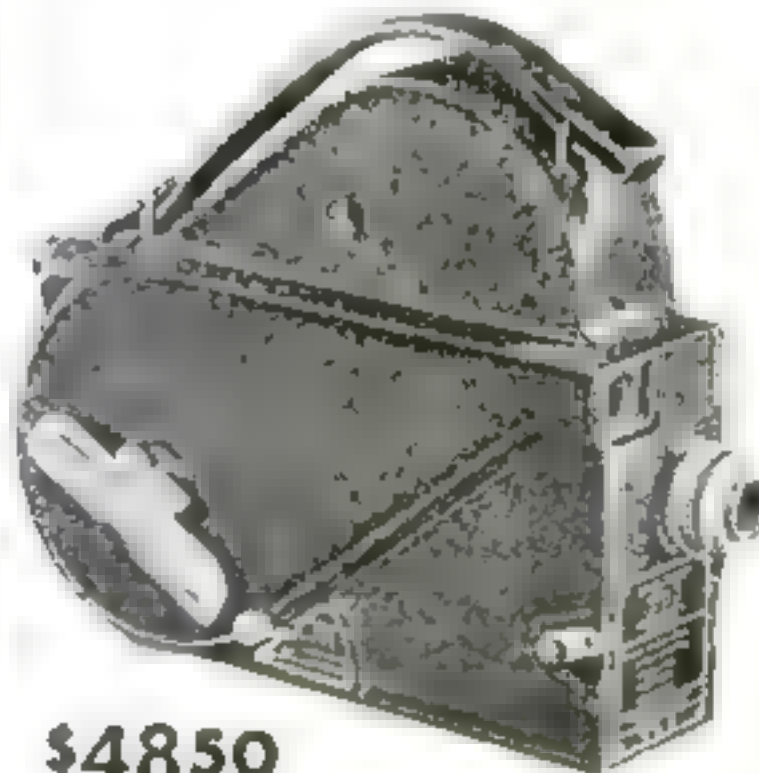


(right)



KODAK RECOMAR 18

Kodak Anastigmat f.4.5 lens, 1/250-second Compur shutter. Built-in self timer. Double-extension bellows and bed. Ground-glass focusing back. Equipped with both wire-frame eye-level and brilliant waist-level finders. Utilizes the almost limitless emulsions available in film packs, cut film and plates. Pictures, 2 1/4 x 3 1/4 inches. Price **\$54**



\$48.50

(left)

CINÉ-KODAK "E"

An Eastman 16 mm. movie camera at the lowest price ever. Kodak Anastigmat f.3.5 lens. Fixed focus—all objects from a few feet distant to infinity are always in focus. Triple-speed device. Simplified gate enormously facilitates loading. Takes all 50- or 100-foot 16 mm. Ciné-Kodak Films. Price, \$48.50.

CINÉ-KODAK "K"

The world's most widely used 16 mm. home movie camera—it's so simple, yet so fine. Makes clear, brilliant movies at the touch of a lever. Performs beautifully for the beginner, and as his skill increases, responds to every exacting demand. Amazingly compact, carries and packs unobtrusively. Loads with full 100 feet of 16 mm. film. With f.1.9 lens. **\$88.50**

Including case, \$100.



(right)

KODACHROME FILM FOR FULL-COLOR MOVIES

Loaded with Kodachrome Film, all Ciné-Kodaks make gorgeous full-color movies. Easy to make as black-and-white. No fuss, no extra equipment; the color is in the film. Here are beauty and realism impossible to describe. The projection of Kodachrome is thoroughly trouble-free. You can splice color sequences right in with black-and-white, project them consecutively without a single adjustment of your Kodascope. See a Kodachrome reel at your dealer's. 16 mm. cameras load with 100-foot rolls at \$9; 50-foot rolls at \$4.75; 50-foot magazines at \$5. Rolls for Ciné-Kodak Eight cost \$3.75. Prices include processing.



\$125

(left)

MAGAZINE CINÉ-KODAK

Loads in three seconds. You don't touch the film. It comes in a magazine. Just slip the magazine into place, close the camera cover and you're ready to shoot. To switch from one film to another, you merely take out a partly used magazine, slip in one of the others. The magazine keeps out the light. Effortless loading is only one of the six new features in this remarkable pocket-size movie camera. With fast f.1.9 lens, \$125; including combination carrying case, \$137.50.

NOW A 7-Inch Genuine BLACK & DECKER ELECTRIC SANDER



THE NEW 7-INCH JUNIOR SANDER saves hours of slow, hard work with sandpaper, emery, files, etc. Makes quick work of such jobs as cleaning and smoothing wood or metal surfaces; removing paint and rust; grinding and smoothing welds and casting ridges; rubbing down new lacquer with felt rubbing pad; polishing metal, etc. Universal motor operates on A. C. or D. C. A great tool. A great value. Only \$39.50.

LOW-PRICED B. & D. DRILLS, TOO

1/2-INCH JUNIOR DRILL: (Illustrated). Drives twist drills for drilling up to 1/2" holes in steel; augers for drilling up to 1" holes in wood. Also drives Black & Decker Hole Saws for cutting clean, round holes from 3/8" to 3 1/2" diameter in any material a hacksaw will cut. Universal motor. ONLY \$35.00.



1/4-INCH JUNIOR DRILL: Drives twist drills for drilling up to 1/4" holes in metal; augers for drilling up to 1/2" holes in wood. Also drives light wheels for grinding, buffing, polishing, etc. Universal motor. ONLY \$19.95.

MAIL THE COUPON TODAY for complete information and name of nearest dealer where you can see the Junior Sander, Drills and other Black & Decker Tools.

BLACK & DECKER

World's Largest Manufacturer of
PORTABLE ELECTRIC TOOLS

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Occupation.....

Address.....

City.....State.....

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Tested by Experts
for Use in Your Workshop

WHETHER you plan to build a ship model, a piece of furniture, a boat, or some novelty, you will find it advantageous to use our Blueprint Service Department. For more than fifteen years we have been supplying home workshop enthusiasts with a wide variety of plans at a nominal price.

Our blueprints have been prepared and tested by experts, and you will experience no difficulty in understanding them. The following are a few subjects selected from our complete price list, a copy of which will be sent free upon receipt of a self-addressed, stamped envelope.



FURNITURE

Bed and Armchair Table, 333A	.25
Cedar Chest, 17	.25
Child's Costumer, 179A	.25
Early American Round-Top Stand, 191A	.50
End Table, American Empire, 241A	.25
Fireplace Bench, Colonial, 187A-188A	.50
Floor Lamp (tripod base), 243A	.25
Four-Leaf Card Table, 239A	.25
Gate-Leg Table with Round Top, 24	.25
Hanging Wall Cabinet, 280A	.25
Kitchen Table Cabinet with Folding Seat (no turning), 27 by 48-in. top, 27	.25
Magazine Rack and Wooden Wastebasket, 296A	.25
Maple Tavern Table, top 30 by 68 in., 318A	.50
Modernistic Lamps (three designs), 93	.25
Queen Anne Dressing Table, Stool, and Mirror, 295A	.75
Reading Tables, Two, 68	.25
Sewing Table, 1	.25
Silverware Chest on Stand, 256A	.25
Six-Footed Coffee Table with Top 14 by 26 in., 14 in. high, 327A	.25
Small Early Colonial Pine Chest, 308A	.25
Smoking Stand, Modern, 238A	.25
Telephone Table and Stool, 18	.25
Tilt-Top Table (turning), 140	.25
Treasure Chests (metal bindings), 78	.25
Upholstered Stool, 240A	.25



MODELS

Aircraft Carrier <i>Saratoga</i> (18 in.) and a <i>Flush-Deck Destroyer</i> (6 1/4 in.), 226-227-R	.75
Army Multiseater Fighter Plane XFM-1, 24 1/4-in. wing spread, 14 1/4 in. long, solid scale model, 334A	.50
Barnegat Lighthouse, 298A	.25
<i>Bluenose</i> , the famous fishing schooner, 17 1/2-in. hull, 110-111-112-R	1.00
Brig <i>Malek Adhel</i> (20-in. hull; frame-and-plank construction), 304-305-306-R	1.25
Clipper Ship <i>Great Republic</i> (31 1/2-in. hull), 272-273-274-R	1.25
Clipper Ship <i>Sea Witch</i> (9 1/2-in. hull), 219	.25
Coast Guard Patrol Boat (20 1/4-in.), 286-287-R	.75
<i>Constitution</i> ("Old Ironsides"), 21-in. hull, 57-58-59-R	1.00
Covered Wagon (23 1/4 in.), 118-119-120-R	1.00
Cruiser U.S.S. <i>Indianapolis</i> (12-in.), 216	.25
Farragut's Flagship <i>Hartford</i> (33 1/2-in. hull), 221-222-R	1.50
Felucca or Barbary Pirate Galley (20 in.), 44-45-R	.75
Freighter, Ocean (14-in.), 271	.25
H. M. S. <i>Bounty</i> (8 1/2-in. hull), 254	.25
Liner <i>President Lincoln</i> (14 1/4 in.), 325	.25
Locomotive Model, Hudson Type, HO Gauge (14 in. long; driven by 6-volt motor), 329-330	.50
<i>Mayflower</i> (24 in.), 83-84-85-R	1.00
New Bedford Whaleboat (14-in.), 328-R	.50
<i>Normandie</i> (20 1/4-in. hull), 264-265	.50
Privateer <i>Swallow</i> , Baltimore clipper, (13-in. hull), 228-229-230-R	1.00
Racing Yacht <i>Seascope</i> (42-in.), 106-107-R	.75
Roman Galley (19-in.), 138-139-R	.75

Ship Model Weather Vane, 66	.25
<i>Sovereign of the Seas</i> , clipper ship (20 1/4-in. hull), 51-52-53-R	1.00
Spanish Treasure Galleon (24 in.), 48-47	.50
Stagecoach with Horses, 144-145-146-R	1.00
Trading Schooner (17 1/2-in. hull), 252-253	.50
U. S. Battleship <i>Texas</i> (3-ft. hull), 197-198-199-200	1.00
Viking Ship (20 1/4-in.), 61-62-R	.75
Whaling Ship <i>Wanderer</i> (20 1/4-in. hull), 151-152-153-154	1.00
Yacht <i>Rainbow</i> (7 1/4-in. hull), 233	.25

{ Construction kits are available for }
{ some of these models. See page 20. }



BOATS

Canoe, 16-ft. Canvas-Covered Kayak, with sail, etc., 192-193-194-R	1.00
High-Speed Boat for Small Outboard Motors (7 ft. 11 in. long), 257-R	.50
Outboard Racer for Class "A" and "B" Motors, (10 ft. 4 in. long), 211-212-R	.75
Racing Runabout (13 ft. long, for outboard motor), 261-262-R	.75
Racing Sailboat <i>Blackcat</i> (13 ft. 4 in. long, 5 ft. beam, weighs 250 lb., Marconi rigged), 321-322-323-R	1.00
Sailboat (12 ft. long; weighs 200 lb.; has fast skimming-dish hull), 314-R	.50
Sport Runabout (9 ft. 8 in. long, 43-in. beam, for small outboard motors), 309-310-R	.75
Utility Rowboat, 13-ft., (can also be sailed or driven by outboard motor), 224-R	.50



RADIO SETS

All-Wave Portable Receiver (two tubes, operated by battery), 217-R	.50
Amateur Short Wave Receiver, 155	.25
Amateur Radio Transmitter, 183-184	.50
Five-Tube Short Wave (A.C. or D.C.), 223	.25
Full Electric Headphone Set, 130	.25
One Tube (battery operated), 103	.25
Screen-Grid Set, 109	.25
Short-Wave Converter Unit, 137	.25



MISCELLANEOUS and TOYS

Airplane Cockpit with Controls, Toy, 114	.25
Baby's Crib and Play Pen, 26	.25
Colonial Doll's House, 72	.25
Doll's House Furniture, 73	.25
Flowerpot Stand (38 1/4 in. high) and Novel Modern Table Lamp, 317A	.25
Four-Treadle Hand Loom, 268A-269A	.75
Metal Sundial (concrete pedestal), 291A	.25
Patterns for Jig-Sawing Birds and Animals, 56	.25
Projector for Photos and Pictures, 259A	.25
Tie Rack, Extension Book Rack, and Turned Box, 247A	.25
Toy Electric Motor, Softwood Coffee Table, and Scottie Pins, 332A	.25
Toy Fire Engine, Dump Truck, etc., 101	.25
Toy Lathe, Drill Press, Saw, and Jointer (driven by small motor), 113	.25
Turned Costume Jewelry, 275	.25

Popular Science Monthly
353 Fourth Avenue, New York

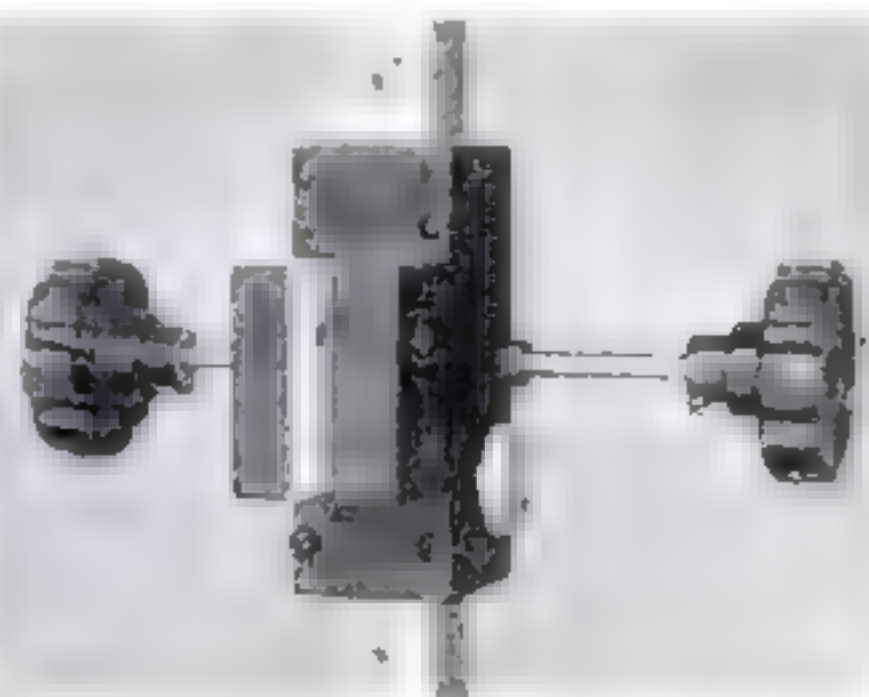
Send me the blueprint, or blueprints, numbered as follows:

I am inclosing.....dollars.....cents

Name.....

Street.....

City and State.....
Please print your name and address clearly.



All-Purpose Stand Aids Amateur Photographer

(Continued from page 106)

squareness, which is most important.

The choice of material rests with the builder. The stand illustrated was made entirely of cold-rolled steel. Brass may be used for the sliding unit, but the upright post is best made of cold-rolled stock of the desired length.

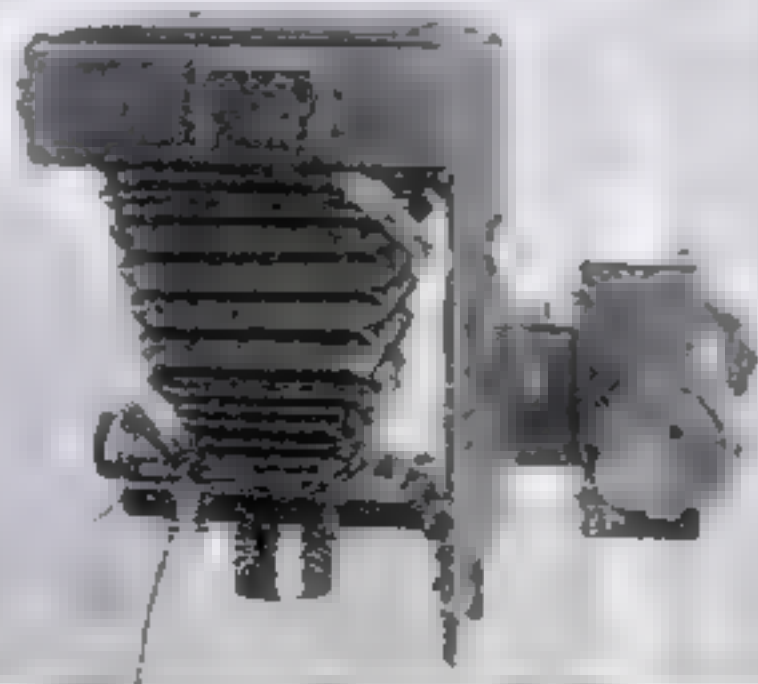
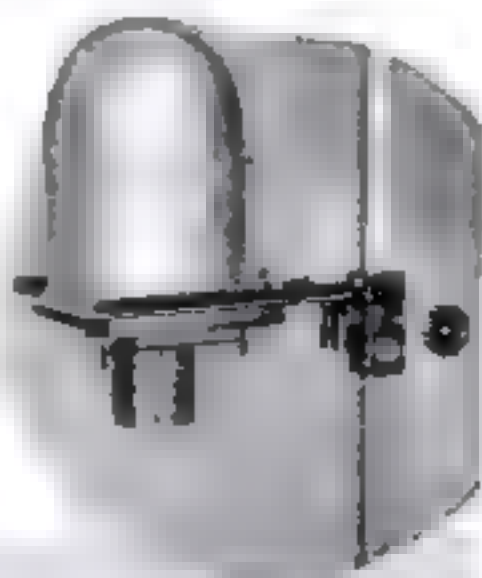
The sliding unit is made of two pieces. When screwed together, it must fit the upright without any side play and still move up and down without binding. The rack is fitted into a groove so that the teeth are flush with the surface. Screws going through the post hold the rack from the back. Inlaying the rack enables the sliding unit to ride on all four surfaces of the upright.

The base is built along the same lines as the sliding unit, but is heavier. The upright should fit into the base tightly and stand perpendicularly as checked with a plumb bob.

The collars, knobs, and pinion are held by set screws, and spotting the shaft with a small drill enables them to get a better grip.

Three ways of fastening an arm to the sliding unit are indicated. In most cases the methods marked A and B will suffice, as they provide horizontal or vertical support. For working with a microscope, however, an angle bracket can be used as illustrated to hold the camera. By the use of a little ingenuity, almost any type of apparatus can be attached.—A. H. HONEST.

Right, homemade enlarger. By inserting arm in slot, it can be set horizontal. Below, angle-bracket mounting, which gives least degree of vibration



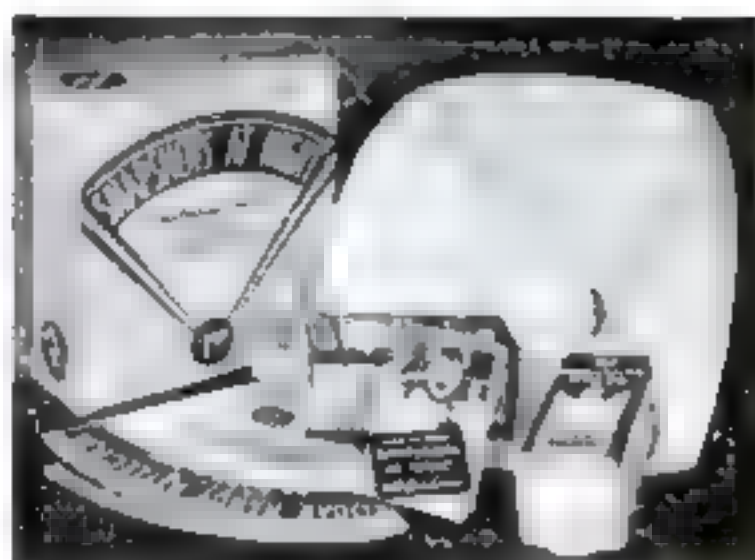
FUN

to snap Christmas pictures



...and easy to get them

WITH G-E MAZDA PHOTO LAMPS



SPECIAL LIGHTING KIT \$1.00 FOR INDOOR PICTURES

Ask the dealer where you buy your film to show you this new special kit for taking indoor pictures with any camera and supersensitive pan film. Consists of:
2 G-E MAZDA Photoflood lamps No. 2;
2 handy paper reflectors to concentrate the light on subjects;
Helpful folder that suggests where, and tells how, to take pictures at night.

● What a Christmas picture Sally makes, sitting proudly by her new doll ...and Junior beating on his new drum! Catch such happy, delighted faces around *your* Christmas tree, and keep them forever...with indoor snapshots.

Just put a few G-E MAZDA Photoflood Lamps in sockets around the room, load up your camera with supersensitive film, and take snapshots as easily as you would outdoors in the sunlight.

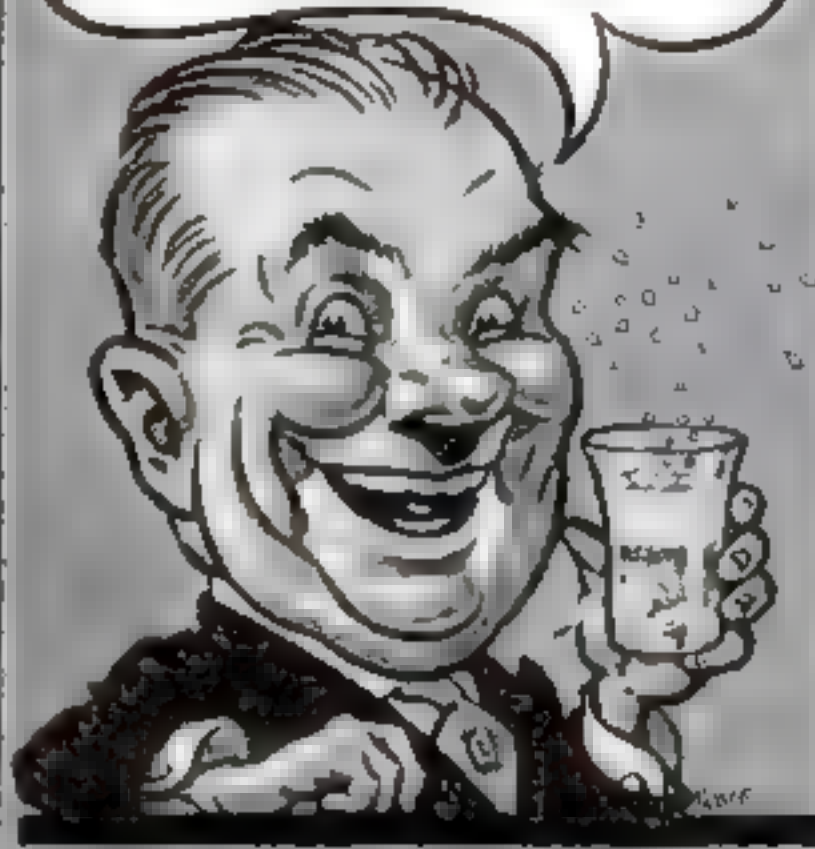
The brighter, whiter light of these amazing bulbs gets you crisp, clear pictures indoors, or at night. And they last for dozens of shots.

For action, use G-E MAZDA Photoflash lamps. Each lamp gets one picture. 15 cents list.

Go to your druggist or camera dealer for photo lamps... but be sure they're marked G-E, to be sure of better pictures.

**GENERAL  ELECTRIC
MAZDA PHOTO LAMPS**

NO UPSET STOMACH TROUBLES ME,
NO "MORNING-AFTER" WOE,
NO HEADACHES STAY TO MAR MY DAY,
THEY SIMPLY HAVE TO GO.
TO NIP A COLD BEFORE IT'S OLD
I ALKALIZE IT WELL, SIR,
I DODGE THE GRIEF AND GET RELIEF
BY TAKING ALKA-SELTZER



When a Headache, Upset Stomach, Cold or some other common everyday ache or pain threatens to spoil your good time—be wise—Alkalize with Alka-Seltzer. A tablet in a glass of water makes a pleasant tasting, effervescent solution, which brings quick relief in TWO ways. Because it contains an analgesic (sodium acetyl salicylate) it first relieves the pain and then because of its alkalizing properties, it corrects the cause of the trouble when associated with an excess acid condition.

ALKALIZE WITH
Alka-Seltzer
AT ALL DRUGGISTS 30¢-60¢ Pkgs.
Also sold by the glass at
Drug Store Soda Fountains

NEW TYPE CHEAP OIL BURNER
Sweeping the Country!!
COOK and HEAT Without Coal or Wood
In Your Present Stove or Furnace—HOTTER—CHEAPER—No Dirt or Ashes—Twice the Heat Quick at SMALLER COST.
COOK and HEAT for LESS
Amazing oil burner burns cheap oil a new way, without pre-generating or clogging up; quick, intense heat at TURN OF VALVE.
SENT ON TRIAL Prove it cuts fuel bills, pays for itself quickly by what it saves at our risk. Offer of **FREE SAMPLE** TO AGENTS. Write to Agents, who will send you a sample and show you how to make big money, spare of full time—mail to nearest today.
UNITED FACTORIES, A-761, Factory Building, Kansas City, Mo.

KINKADE GARDEN TRACTOR
and Power Lawnmower
A Practical, Power Plow and Cultivator for Gardeners, Fruit Growers, Truckers, Florists, Nurserymen, Suburbanites, Country Estates and Poultrymen.
Low Prices—Easy Terms
AMERICAN FARM MACHINE CO.
1072 33rd Ave. S. E. Minneapolis, Minn.

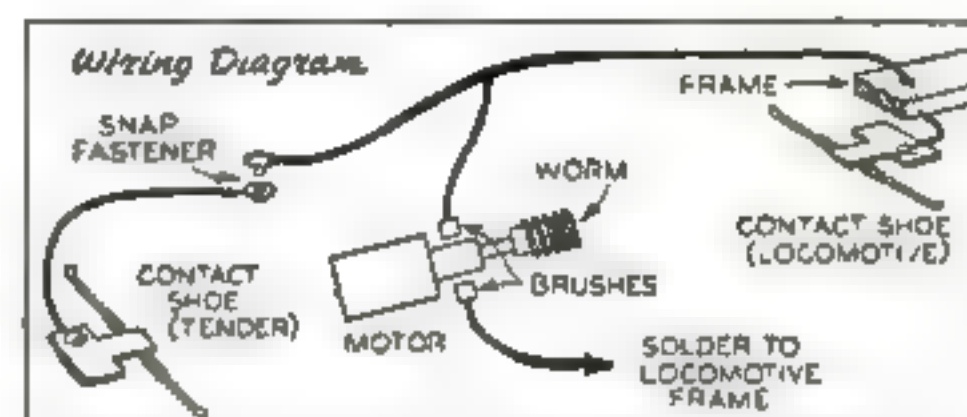
Tender for New Locomotive Model

(Continued from page 86)

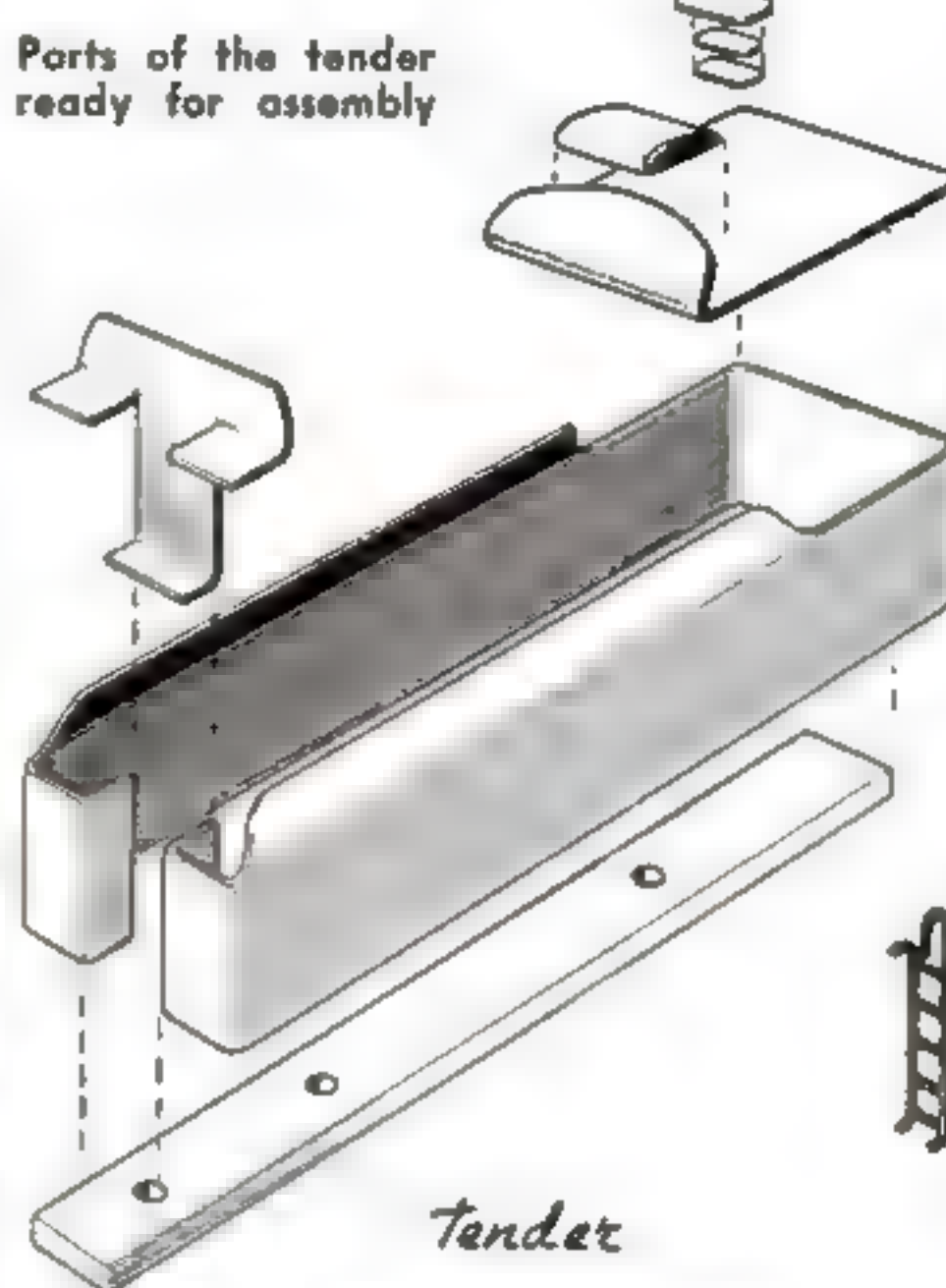
shoe is of a special design intended to give flexibility without dragging excessively on the third rail. It consists of a $\frac{3}{8}$ -in. length of fairly heavy coil spring into the ends of which are soldered pieces of brass wire. The center of the spring is soldered to a T-shaped brass bracket, as shown. In making the shoe, be careful the solder does not run into the coils of the spring and join them together. Two bolts, with their heads filed off thin, hold the shoe to a piece of fiber, which is fastened under the first pair of nuts beneath the engine frame. This construction is shown in one of the drawings.

After having built the locomotive, the tender is a simple job. There are no

the other brush through the hole provided in the front of the frame and back to the contact shoe. Another wire, leading from the tender contact shoe, is joined to this same brush of the motor. If desired, a snap joint may be provided between the locomotive and tender by soldering the ends of this wire to the two halves of a small snap fastener of the type used on dresses. This hangs



How motor is connected with contact shoes



new tricks to learn. The frame is $\frac{1}{8}$ in. by $\frac{1}{2}$ -in. brass, and to this is soldered one long piece comprising the sides and ends, bent as shown. If you do not have a single piece of sheet metal long enough, you can, of course, make joints at the corners. Note how the front plate is bent and soldered in. Add this and the rear deck, then put on the details shown in the drawings.

The tender trucks are built up in the same manner as the trailing truck of the locomotive. Cut four metal blanks, solder them together temporarily, file to the shape of the truck side, and drill the axle holes. This makes all four sides alike. Then add the journal boxes and make the crosspieces. Note that the trucks are not pivoted in the center—the pivot is offset to clear the center axle.

The contact shoe of the tender is the same as that of the locomotive, except for the method of mounting. Two triangles of fiber are used, the shoe being bolted to one, and the other acting as an insulator for the screw heads.

To wire the locomotive, take one of the wires connected to the brushes and solder it to the frame of the motor to act as a ground. Then run a wire from

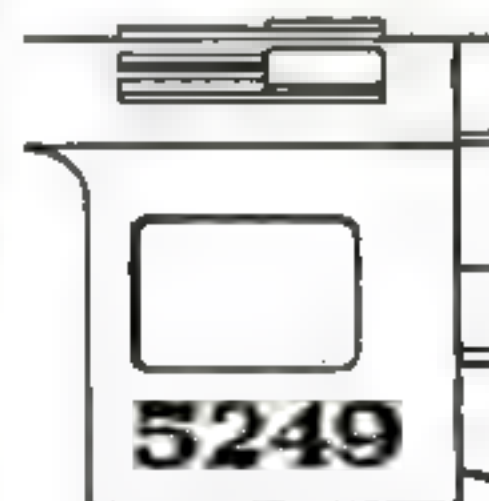
down and looks like the air-brake connector of the real locomotive.

The tender is coupled to the locomotive by a length of brass strip made as shown on page 83 last month. One end fits under the spring of the rear pony-truck pivot, which holds it in position so that the 2-56 screw provided in the front of the tender can hook into the other hole. The connector is bent, of course, to clear the axle.

Painting the locomotive is a job that has to be done just as carefully as the actual construction. First wash the parts in gasoline, then scrub in a hot solution of trisodium phosphate (a standard type of soapless kitchen cleanser) and rinse in water. Do not handle the metal with the fingers after cleaning. The best paint to use is a semiluster—a glossy finish does not look well. If you cannot obtain a paint or lacquer that is dull enough, rub the finish lightly with powdered pumice and oil. As a final touch, paint the smoke box (the part of the boiler in front of the throttle cover) a dead, flat black absolutely without gloss. Leave the driving rods and wheel rims with their original brass luster; or nickel plate them to resemble the steel of the prototype.

Lettering is accomplished with a fine camel's-hair brush and white oil paint. If you have never before attempted a job of lettering like this, paint a few scraps of metal black and practice on these until you can do the job well.

A load of coal for the tender completes the locomotive. About the easiest way to make this is to insert a block of balsa wood in the coal compartment, cover it with a layer of model-airplane cement, and sprinkle on crushed coal.



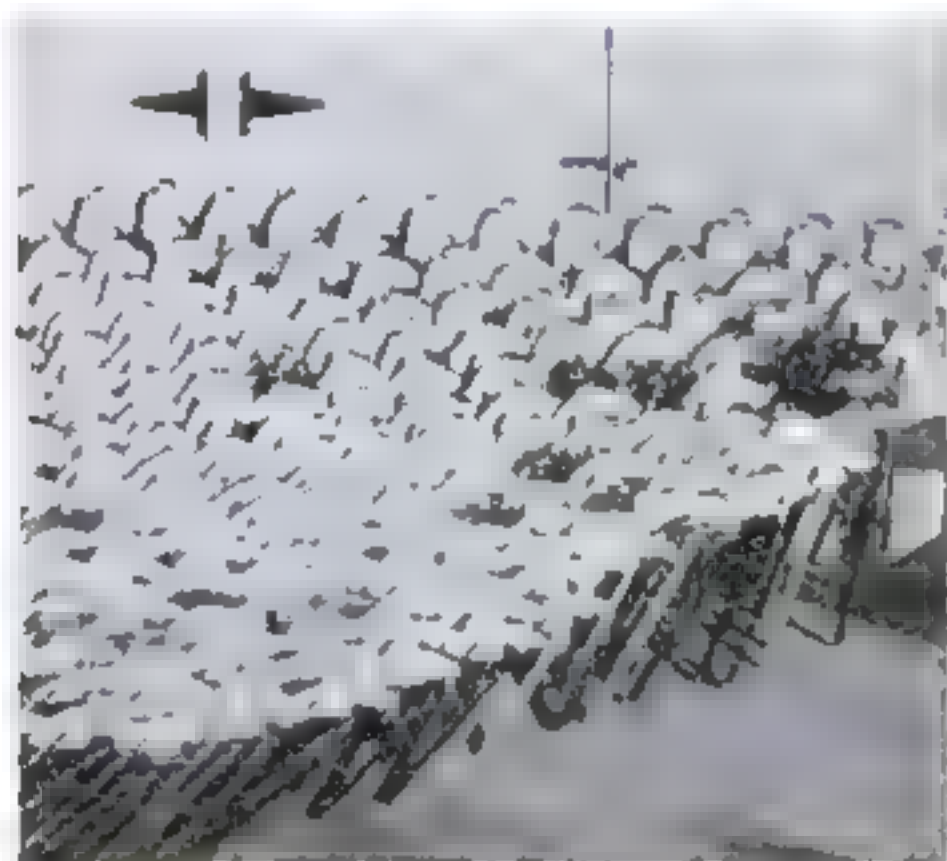
Number on the locomotive cab, full size

Electric Pencil Is Aid in Decorating Models

AN ELECTRIC wood-burning pencil is useful in decorating ornate ship models, such as a Spanish galleon. Fine carving on prow and sternboard may be done with the pencil; and where delicate painting is required, the outlines may first be burned in. Water-color washes are then used, and the burned lines keep each wash from flowing beyond its proper place. The underlying wood grain will show through and give a good antique effect. Before applying any color, it is well to moisten the wood where you want that color, but be careful to avoid dampening any of the wood outside the burned outline for that particular color.—JOHN B. NEWLIN.

Clubs Play Santa Claus

(Continued from page 81)



Hobbyhorses made by Denver (Colo.) club

Chest and making toys to give local needy children at Christmas. . . New officers of the Handicraft Club of Milwaukee, Wisc., are George Smith, president; Verne Villman, vice president; Herbert Winters, secretary-treasurer; Dr. Roland W. Hambach, librarian. . . James Arnish of the Sunset Social and Hobby Club, Brooklyn, N.Y., is building a lathe he designed himself. Edward Korsberg and Bennie Amodeo have been making model airplanes.

Poor children in Dover, N.H., and vicinity are being cheered this Christmas with small carts and wheelbarrows with aluminum wheels, girls' chests, and doll beds made by the Dover Homecraft Club and distributed through the Red Cross. The club also mended and painted a great many toys. At a recent meeting, Norman Seavey, the club's sponsor, showed moving pictures of a trip abroad and exhibited foreign craftwork.

Acting on the suggestions in a recent Guild bulletin, the Spindle City Homecraft Club of Cohoes, N.Y., has appointed Frank Murnane and Nickolas Cappabianca to plan an extensive publicity campaign. Projects made during the summer were exhibited.

Moving pictures of Mexico, with special close-ups of carvings in the pyra-

(Continued on page 114)



*-this Christmas
you hit it right
on the nose, Dad*

Here's sweet mild
Kentucky Burley... with
a flavor that's different.
Try Velvet... you'll
like it.

*Better
Smoking
Tobacco*



HERE'S WHY
you'll like VELVET

- aged-in-wood
Burley tobacco
- extra good taste
- for pipe or
cigarette

2 full ounces
in every tin

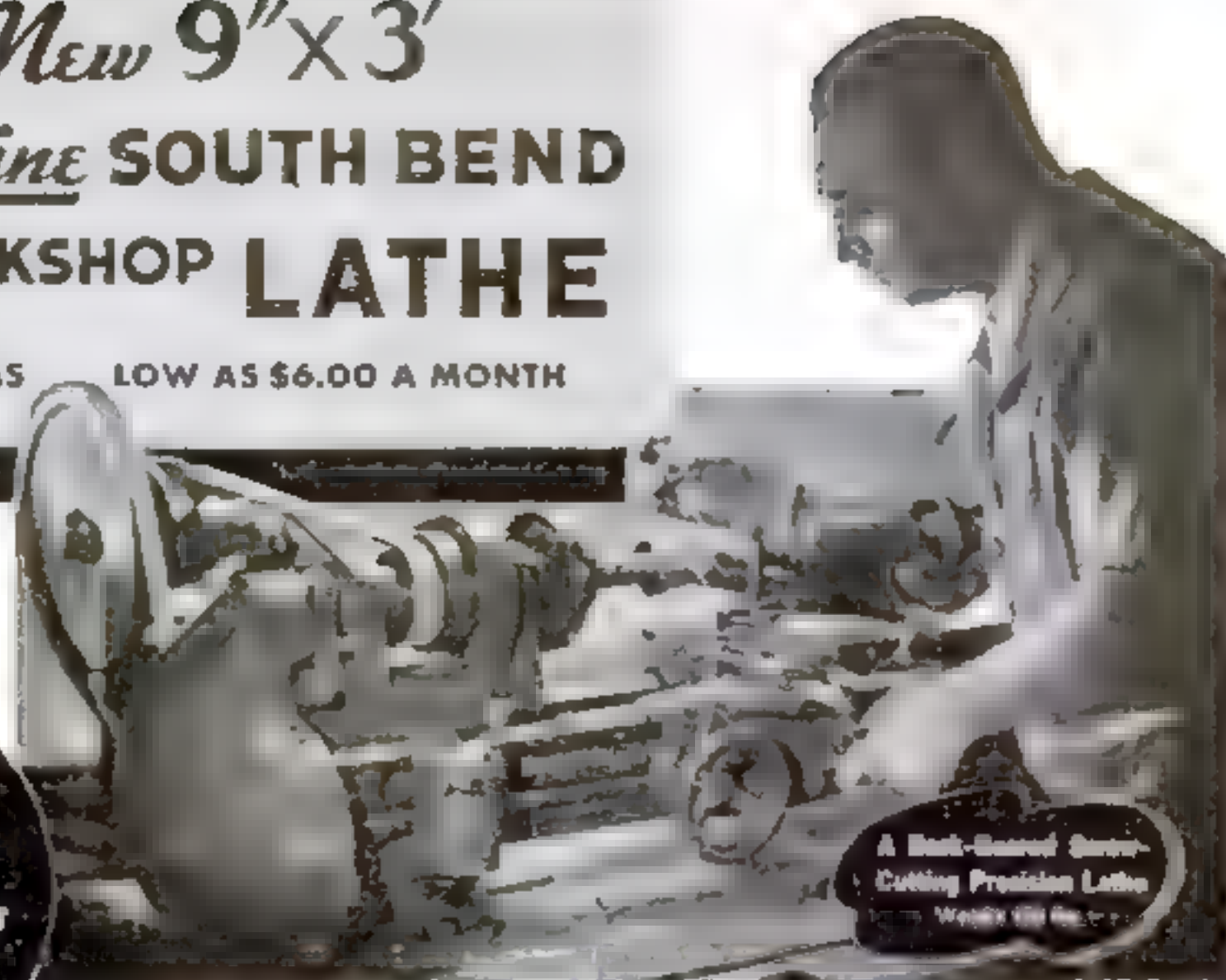
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LIGGETT & MYERS
TOBACCO CO.

New 9" x 3' Genuine SOUTH BEND WORKSHOP LATHE

TERMS AS LOW AS \$6.00 A MONTH

Operates from any
ordinary lamp
socket.

90⁰⁰
Less Motor Drive
AN IDEAL XMAS GIFT
Immediate
Deliveries



A Back-Geared Screw-
Cutting Precision Lathe
— Works All Sizes —

No. 415-YA, 9 1/2" swing by 3' bed Workshop Bench Lathe with
Horizontal Motor Drive, 1/2 H.P. Reversing Motor, Switch,
Belts, and Adjustable Belt Tension Countershaft..... **\$122.00**
(\$15.00 down, \$6.00 a month for 18 months.)

THE new 9-inch Workshop Precision Lathe is a back-geared, Screw Cutting Lathe, and has the same workmanship and materials as our larger, more expensive models.

It is designed to handle the finest, most accurate jobs in manufacturing—in the tool room, in home workshops, and automotive machine shops. This lathe represents the greatest value we have offered in 31 years of fine lathe building.

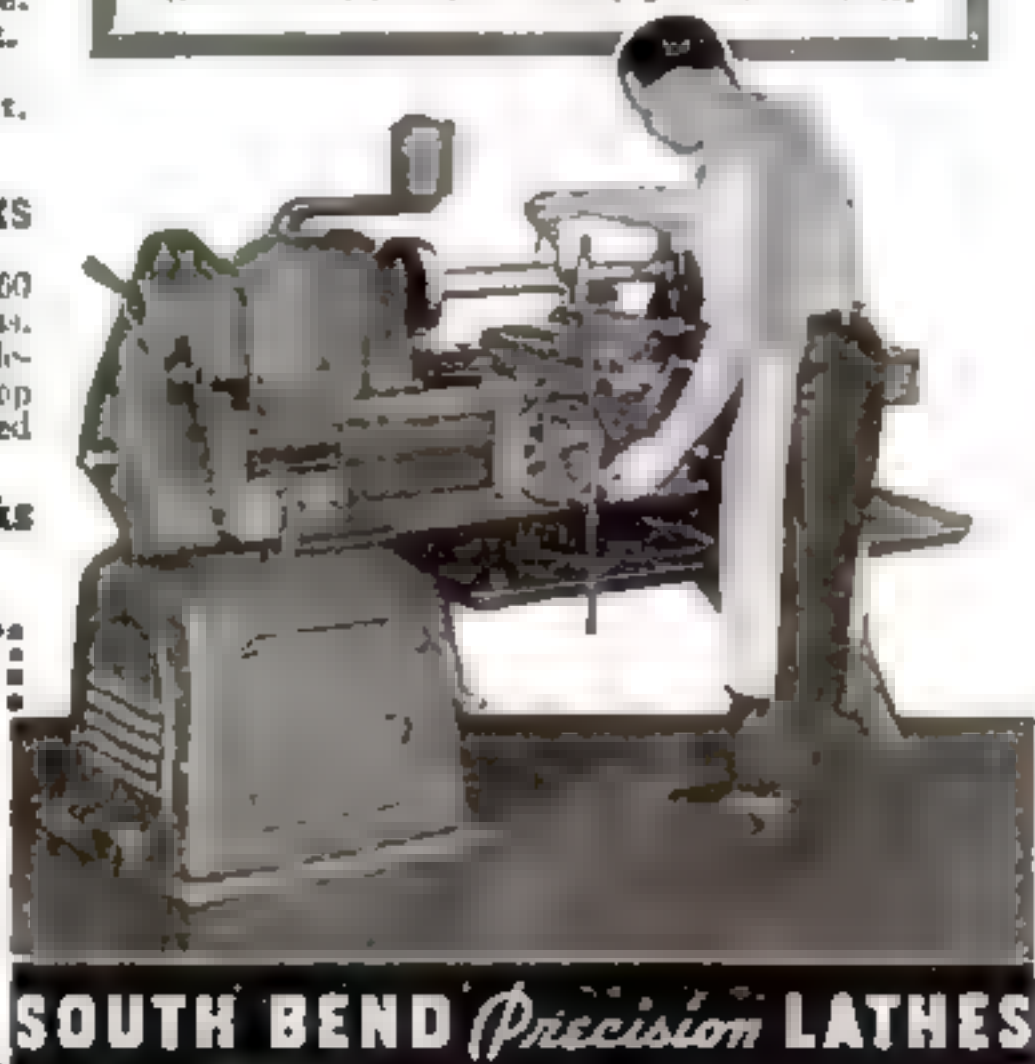
Features include Twin Gear Reverse to lead screw, Ball Thrust Bearing on Spindle, Auto-

matic Longitudinal Screw Feed to Carriage, Precision Lead Screw for Cutting screw threads from 4 to 40 per inch, 1/2-inch hole through spindle taking collets up to 1/2-inch capacity. Takes 38 attachments for milling, grinding, draw-in Collet chuck work, etc.

Write for information on this lathe and larger sizes in motor drive and countershaft drive. Use the coupon shown below.

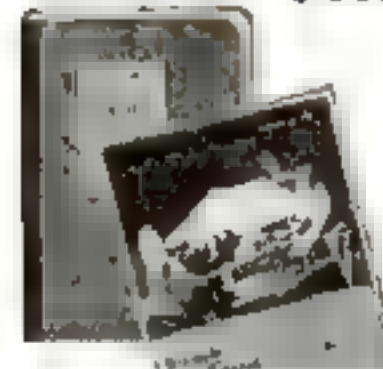
5 OTHER SIZES: 8", 11", 13", 15" and 16" SWING
IN ALL BED LENGTHS—PRICED \$102 to \$1500.

Lathe shown below is No. 117-C, 16" x 6' Quick
Change Gear Underneath Belt Motor Driven Lathe
with 1 H.P. motor. Complete as shown, **\$969**
Weight 2300 lbs.....
(\$97 down, \$13.50 monthly for 22 months.)



SOUTH BEND Precision LATHES

Write FOR THESE BOOKS



"How to Run a Lathe" has 160 pages with over 300 illustrations. 25c each. Catalog 15-Y describes and prices 9" Workshop Lathes in 8 drives and 4 bed lengths. Sent free.

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818 East Madison St.,
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South Bend Lathe Works,
818 E. Madison St., South Bend, Ind., U.S.A.
Please send me the following:
☐ No. 33LB "How to Run a Lathe," 25c
☐ No. 15Y 9" Workshop Catalog, Free
☐ Easy Payment Purchase Plan
Class of Work.....
Name.....
Address.....
City..... State.....

Clubs Play Santa Claus

(Continued from page 118)

mids and old cathedrals, were shown by Dr. A. C. Holt, pastor of the First Presbyterian Church, to the Jacksonville (Fla.) Homeworkshop Club. A demonstration of French polishing by a local manual training instructor followed. Many beautiful pieces of furniture and novelties were brought in for the annual Christmas auction.

New officers of the Stout Arts and Crafts Club, Menomonie, Wisc., are Earl Laatsch, president; Nell Blank, vice president; Wayne Pool, secretary; Robert Ritter, treasurer; Stanley Fox, librarian. . . Dr. R. T. Matthews was host to the La Grange (Ill.) Homeworkshop Club in his shop recently. . . A. Hasselman, superintendent, and

Twenty-Six Clubs Join Guild in One Month

A NEW record was established at Guild headquarters recently when twenty-six clubs joined within one month. Some had fifty or more members. This is just an indication of how the home workshop hobby is sweeping the country. During the past few months, clubs have been granted charters in the following cities and towns:

Acton, Ont., Can.	London, Ont., Can.
Baltimore, Md.	Long Beach, Calif.
Berlin, N. H.	Lynbrook, N. Y.
Blackfoot, Idaho	Mandan, N. Dak.
Carrick, Pa.	Milwaukee, Wisc.
Chaska, Minn.	Nanticoke, Pa.
Chicago, Ill. (2)	New Bedford, Mass.
East Haven, Conn.	Newark, N. J.
Euclid, Ohio	Niles, Calif.
Hannibal, Mo.	Nutley, N. J.
Hialeah, Fla.	Oakland, Calif.
Hudson, Mass.	Sioux City, Iowa
Jaeger, W. Va.	Summersville, Mo.
Jersey City, N. J.	Vicksburg, Miss.
Lake City, Minn.	Villa Park, Ill.

R. D. Paton, foreman of the tool department of a clock company, led a discussion on "Precision Bearing" at a meeting of the Tri-City Homeworkshop Club, La Salle, Peru, and Oglesby, Ill., at the home of J. C. Rucinski. . . The Vicksburg (Miss.) Homeworkshop Club was organized recently at the home of Theodore E. Stepan, who was elected president. T. O. Pike was named secretary-treasurer. . . Plans for the first annual banquet are being formulated by the Fort Stanwix Hobby Club of Rome, N.Y.

Members of the Spokane (Wash.) Homecrafters exhibited wood-inlay pictures at the inlay exhibit in the San Francisco (Calif.) Museum of Art during December. A demonstration of upholstery was the feature of a program at the home of Dr. James Thomson. Fabrics, types of springs, webbing, and other necessary materials were discussed.

For the past month members of the Orchard Park Homework Club of West Lynn, Mass., have been etching their own Christmas cards. Previous to this the club took up uses of the

(Continued on page 115)

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IDEAL
XMAS
GIFT

POCKET CASE

Wissen Memindex Co.

Clubs Play Santa Claus

(Continued from page 114)

ordinary pocketknife, printing, and bookbinding.

Informal lawn parties to which women were invited proved so successful for the *Mount Vernon (N.Y.)* Homecrafters Club last summer that the members decided to have a ladies night at least once every other month and to follow the same idea next year. A combination metal and wood-turning lathe has been added to the club's equipment.

The Passaic County Homeworkshop Club of *Hawthorne, N.J.*, recently attended a demonstration of shop tools at a Hackensack department store and then visited the newly equipped shop of John Nick, a member. The club's first exhibition will be held in January.

Two members of the Roseland Homecraft and Hobby Club, *Chicago, Ill.*, have added considerable equipment to their workshops. Stewart A. DeJong, president, purchased \$500 worth of tools and machinery; John W. Hough, secretary, bought a combination saw and jointer, and in the near future another member expects to enlarge his shop.

A demonstration on the circular saw and planer featured a meeting of the *Fall River (Mass.)* Homecraft Club at the home of C. Schlemmer. New officers are George Legault, president; Walter G. Sweeney, vice president; Albert Boutin, secretary; Manuel Estrella, treasurer.

Send for Free Bulletin on Organizing a Club

START the year right by organizing a home workshop club and joining the National Homeworkshop Guild. If you like to make furniture, models, novelties, and the like, there is no better way to improve your craftsmanship than to belong to a club where all the other members are interested in the same hobby.

To help you get under way, the National Homeworkshop Guild has prepared a special bulletin telling just how to start a club and explaining what the Guild will do for you. It will be sent free upon receipt of a self-addressed, stamped envelope. Fill out the coupon below or, if you prefer, write a letter, and full information will be sent immediately.

National Homeworkshop Guild
347 Fourth Avenue, New York

I want to know more about the National Homeworkshop Guild. In the large (legal size), self-addressed, and stamped envelope I am inclosing, please send me full information on how I can organize a home workshop club and enjoy the many benefits of membership in the Guild.

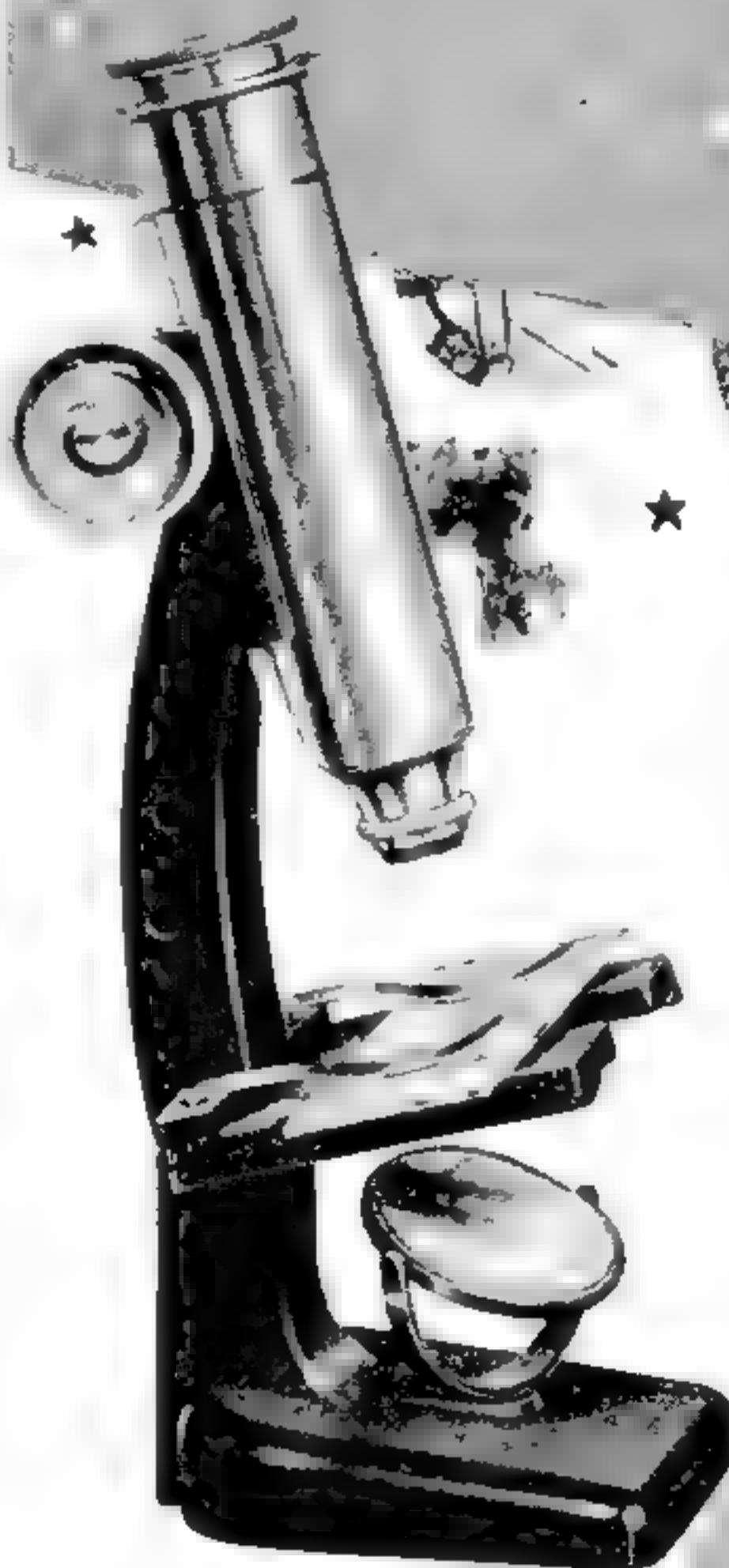
Name _____
Address _____
City _____ State _____
(Please print very clearly)

A MICROSCOPE

for Christmas

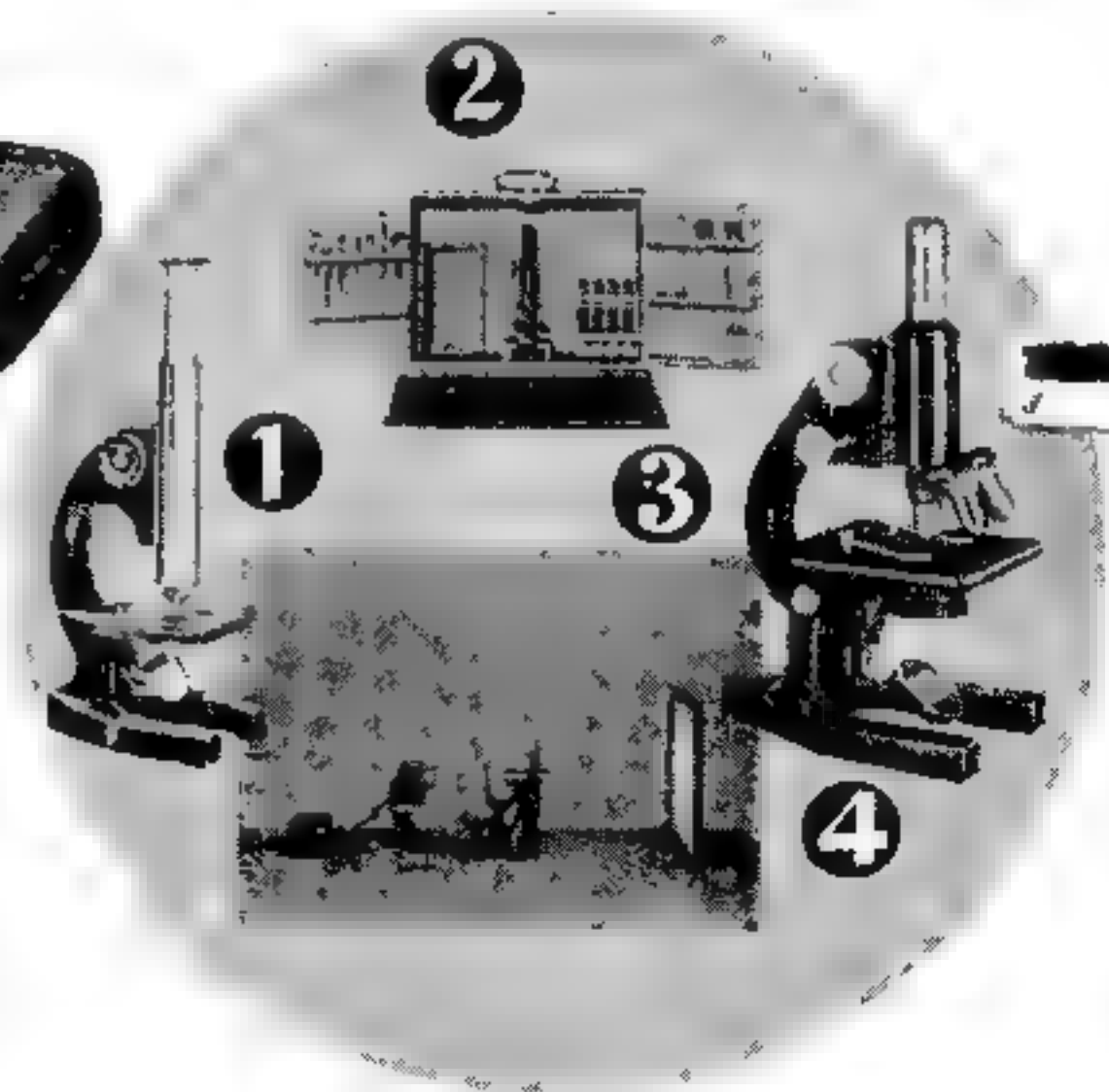
OPENS UP A LIFE-TIME

OF EXPLORATION



The nature and science enthusiast who finds a microscope among his Christmas gifts, stands on the threshold of a life-time of thrills and excitement. For there are worlds yet to be explored—worlds whose mysteries can be fathomed only through the magic of the microscope. The pleasures of microscopy start with the first view of the unseen world, and continue through the years, each new discovery a stimulus to further exploration. But be sure the microscope you buy is a *precision* instrument—one which will give you the sharp clarity that the scientist properly demands from his equipment.

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1938

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A Chest for Silverware

(Continued from page 73)

Before gluing, be sure the insides of the drawer shells are smooth. Have your clamps set about the right distance and ready for instant use, and use a heavy board at bottom and top to protect the surface from clamp marks. Do not use so much glue that it will be squeezed out on the inside.

While this assembly is drying, the drawers can be made. The fronts are rabbeted; the backs, flush. The three sides and the bottoms are of $\frac{1}{4}$ -in. mahogany; the fronts of the two side drawers are $\frac{1}{2}$ -in., and the front of the center drawer is $\frac{3}{4}$ -in. to allow for the projecting curve. Check the drawer dimensions from the cabinet itself, because if the casings have shifted the slightest fraction in gluing, the drawers might be too large or too small.

Particular care should be given to sanding as the final finish will reflect only what you see in the raw wood. Start sanding with No. 1 paper and finish with No. 5/0. Stain, fill, and varnish the wood, and rub the last coat of varnish to a piano finish with powdered pumice stone and oil, followed with rottenstone, if desired. In applying the filler, brush it across the grain; then, when it has become dull but not thoroughly dry, rub off in a circular motion with burlap.

The racks to hold the silverware must be made to fit your own particular style of ware. Prepare three blocks as shown and cut the slots smaller than required; then gradually increase the size until you find the silverware fits snugly when the velvet or other lining material has been temporarily pushed into place.

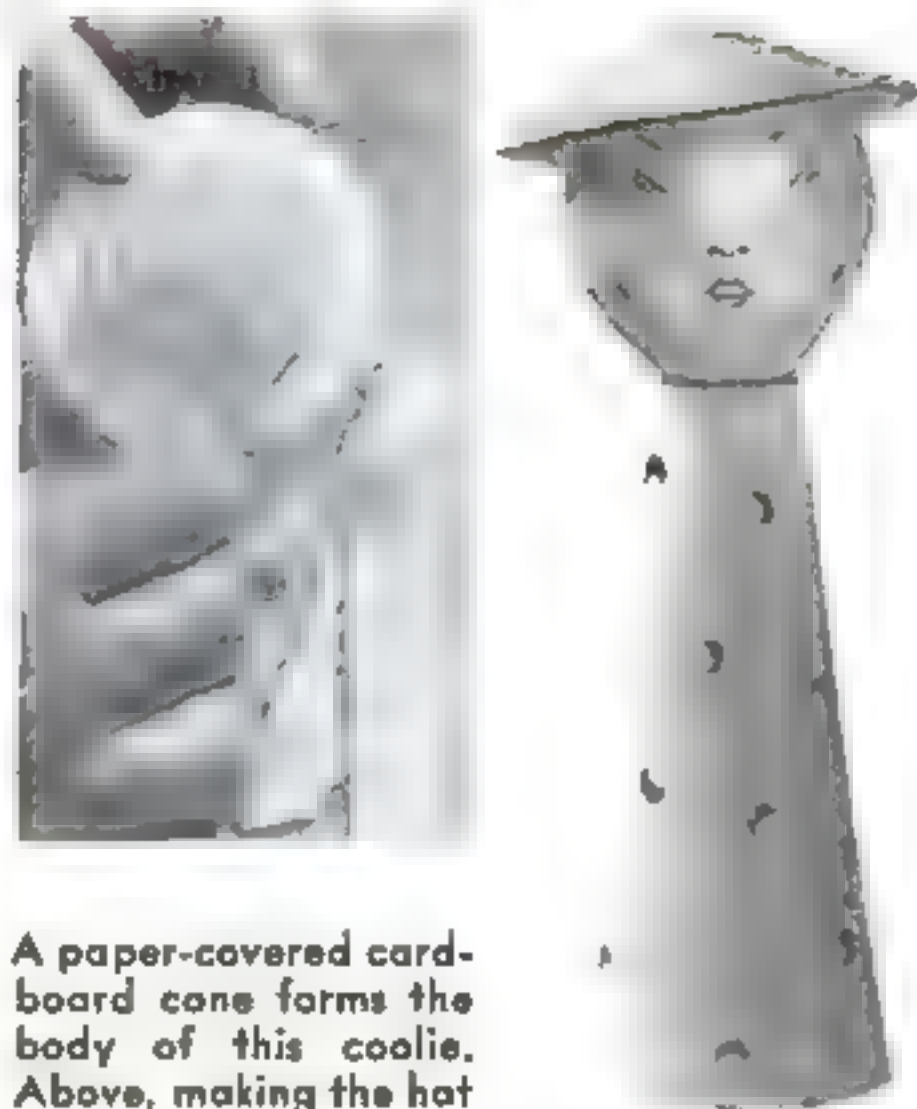
In covering these blocks, cut a piece of the cloth large enough to poke down into each slot and turn over the ends, and wide enough to pull down over the sides and under the bottom. Spread glue on the block but not into the slots, and starting with one end, push the velvet into the slots and pull the four sides tightly over the bottom. Secure it with small tacks and trim off any excess. Cut from cardboard pieces slightly smaller than the drawers and cover these too with the velvet or other material. Tack the blocks to the cardboard and insert the complete units into the drawers.—W. J. GEE, JR.

LIST OF MATERIALS FOR FOLDING DRAFTING TABLE

(Described on page 72)

No. Pcs.	Description	T.	W.	L.
1	Front	$\frac{3}{4}$	$3\frac{1}{4}$	30
2	Rails	$\frac{3}{4}$	$2\frac{1}{4}$	27
2	Legs	$\frac{3}{4}$	$2\frac{1}{4}$	$28\frac{1}{2}$
1	Spreader	$\frac{3}{4}$	$2\frac{1}{2}$	$22\frac{1}{2}$
1	Spreader	$\frac{3}{4}$	$2\frac{1}{2}$	21
2	Braces (flat steel)	$\frac{1}{4}$	1	$6\frac{1}{2}$
2	Plates " "	$\frac{1}{4}$	1	$1\frac{1}{4}$
4	Flathead wood screws, 1-in.	No. 10.		
16	" "	" $1\frac{1}{2}$ -in.	No. 10.	

NOTE: All dimensions are given in inches.



A paper-covered cardboard cone forms the body of this coolie. Above, making the hat

Making Laughable Lamps

(Continued from page 65)

drawn and glued. The strips may also be twisted into fine or coarse rope and either wound over the body or used to make the facial characteristics. When it is applied to the light bulbs, use cellulose cement. Do not cover much of the bulb because even these small ones get quite hot. Avoid metal sockets, and take precautions against scorching the paper accessories.

India ink or black asphaltum varnish can be used for the features, if you wish to paint them on, but do not try to use water colors or ordinary enamels as they may chip or peel off. For convenience in handling, screw the lamp into a socket while decorating it.

A dark-colored lamp is used for making the bell boy. The hat is part of a pill box covered with crepe-paper rope, which is also used for the eyes and mouth. Paper-covered wire arms are attached to a cardboard box for the body, and the box is covered with wide strips of tan and white crepe paper. The buttons are of cardboard.

In making "The Thinker," the lamp socket is covered with black paper and utilized as the body. Before attaching the pipe-cleaner arms and legs, coat the joints with cellulose cement and allow it to dry; then add another coat and press the parts together. A piece of wire bent to shape serves as spectacles. The eyes, nose, and mouth are cuttings from red paper, attached with cellulose cement.

The "Lady in Red" has India-ink features, and the lamp socket is held in a wire framework covered with a red crepe-paper dress. The "White Widow," which is intended for a man's den, has a small $7\frac{1}{2}$ -watt bulb for a head.

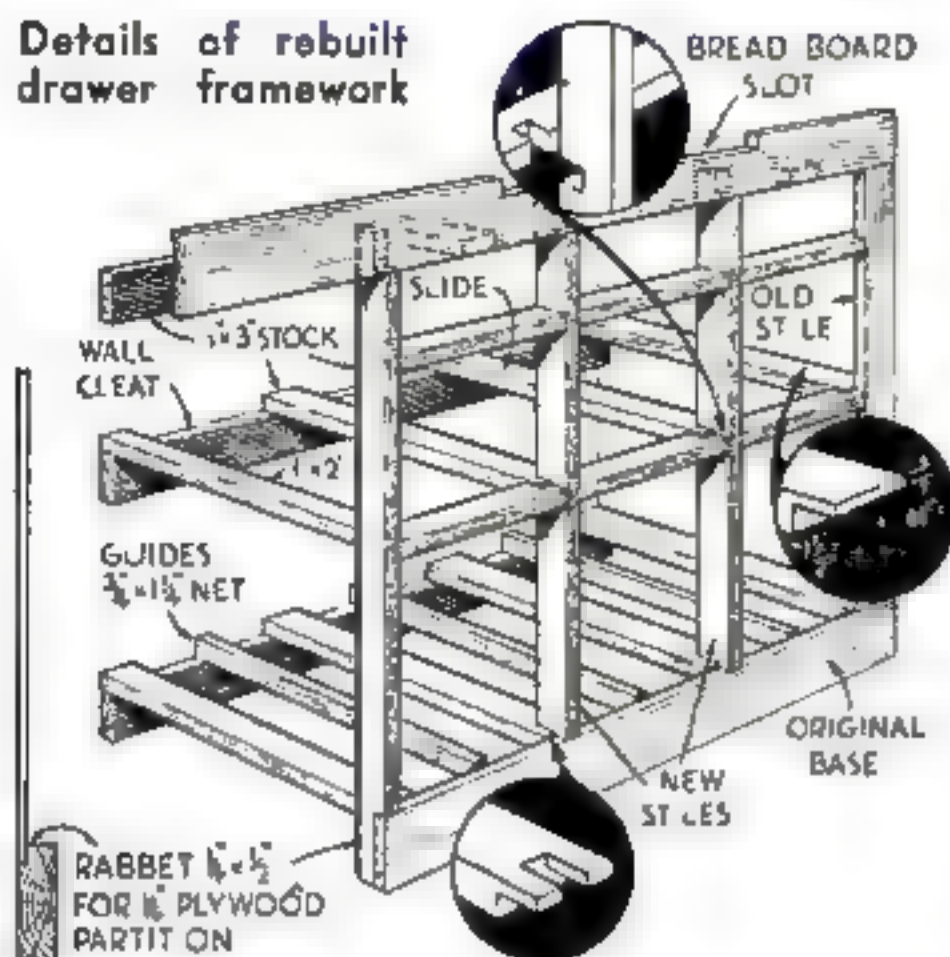


"The Thinker" has a black paper-covered socket. His glasses are bent from wire

Modern Kitchen Cabinet

(Continued from page 77)

Details of rebuilt drawer framework



arranged to suit them; but door stiles must lie in the same plane if doors are to close properly. The lower section must generally be fitted to the drain-board apron. Parts for the drawer chest can be made in the shop.

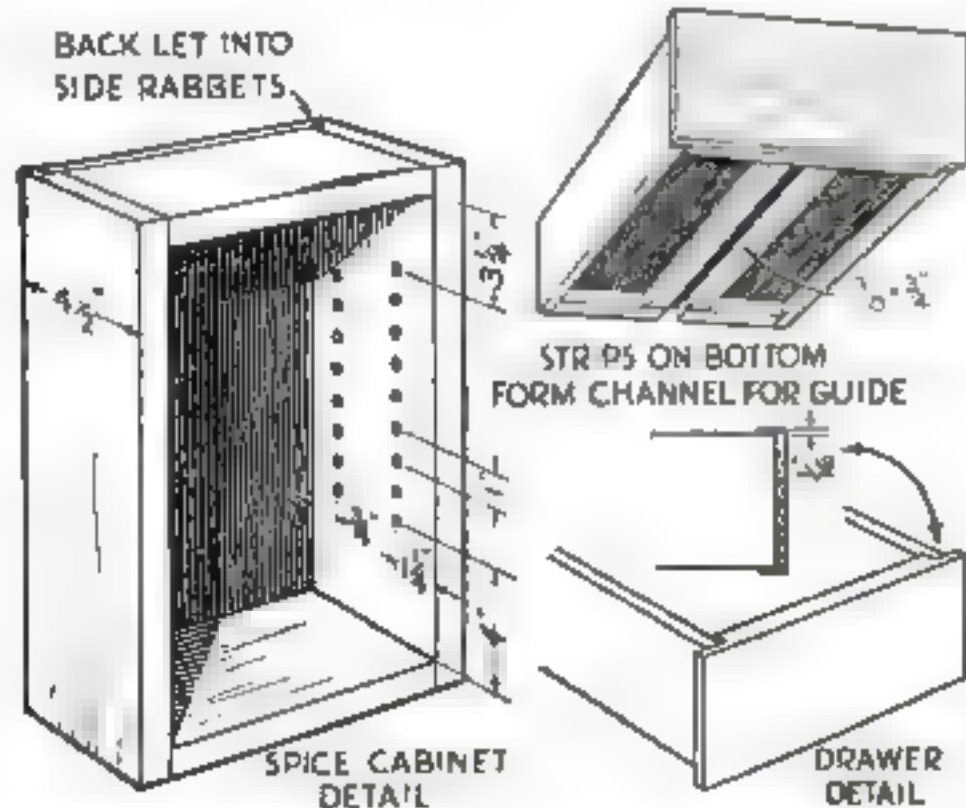
When putting in shelves for flush doors, remember that paint on the edges takes room, so that stiles 1/16 in. thicker than the doors should be used to provide clearance, or pasteboard shims can be inserted behind the stiles. Where a rail is used, a bottom shelf should project 1/4 in. above the rail to act as a stop.

Several styles of doors may be used, such as described in "Good-Looking Doors" (P.S.M., Nov. '36, p. 114). Lip doors, like lip drawers, are easiest to fit, but the extra projections catch dust.

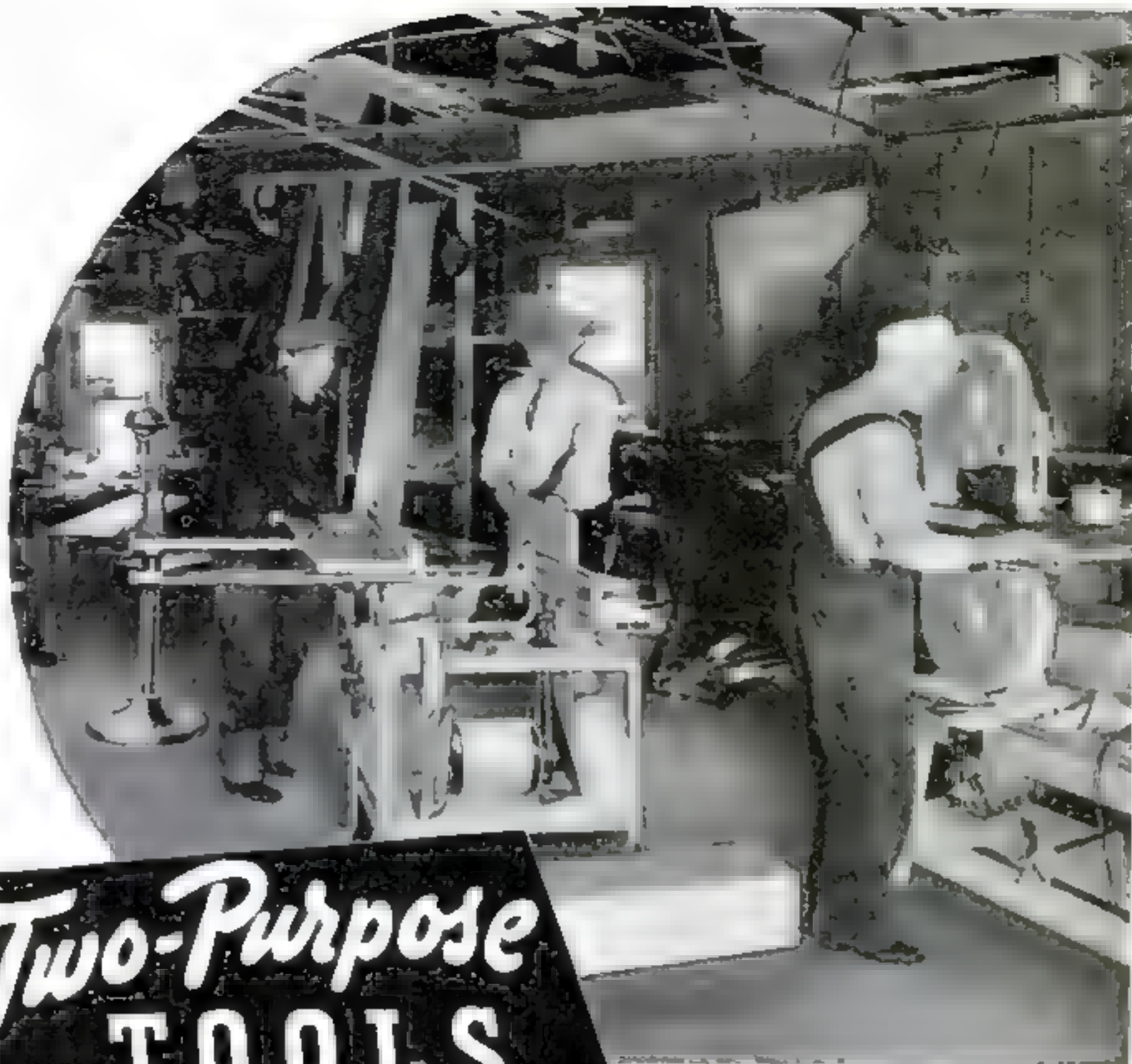
The drain board and splash back of an old cupboard can often be made presentable. If of wood, remove all rotted portions, fill in with wood composition, and level off scars and checks. Remove the old paint, if necessary, and sand to a smooth surface. Paint as desired, finishing with an acidproof varnish.

Linoleum makes an attractive drain-board covering. The inlaid variety with an adhesive back is best, since no cement is needed. Apply in one piece over the old wooden board and splash back, and trim out the sink opening. Bind the edges with a metal molding.

Old composition drain boards, especially of the so-called "wood-stone" type, are often great eyesores. Fill the pits with a tile or plaster composition, then paint and coat with varnish.



How the drawers and spice cabinets are made



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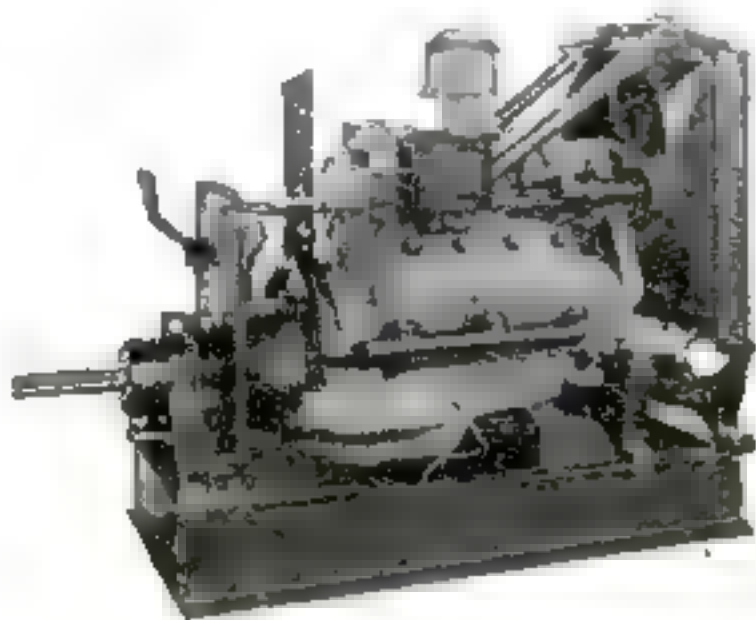
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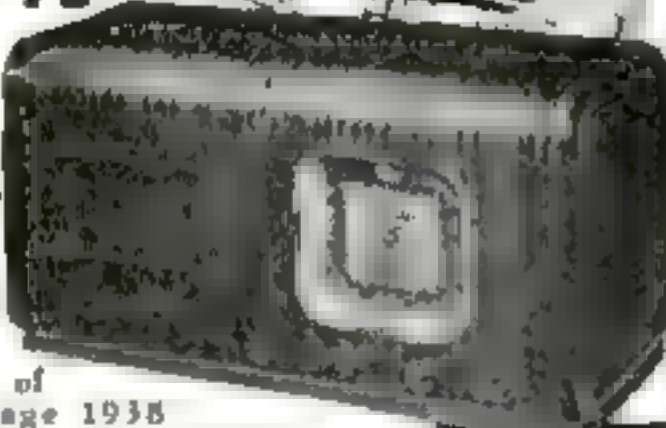
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Hook a Camera to Your Microscope

(Continued from page 95)

croscope until an image is visible on the ground glass. Probably the brilliancy of this image will not be very great, even at low magnifications. Now focus the microscope as sharply as you can, using a small hand magnifier, if necessary, to examine the image on the ground glass. Remove the glass and substitute a film holder for it. Stick a piece of cardboard between the substage mirror and the light source, to keep light out of the camera, and pull the slide out of the film holder. Now, using the cardboard as a crude shutter, make the exposure. As for the length of the exposure, you'll have to determine that by experiment, or else be lucky at guessing. As a start, try five seconds at a magnification of 100 diameters.

ALTHOUGH you can use daylight for such work, it is a lot more convenient to employ a high-intensity source of artificial illumination. Photoflood lamps, intended primarily for general photographic work, offer a simple way of doing this. You can mount one of these lamps about six inches from the substage mirror or, if directly in line with the objective so that no mirror is necessary, about the same distance from the slide, and use it without any auxiliary equipment. But you are likely to find that the illumination is rather poor, if your microscope does not have a substage condenser. It is of considerable advantage to interpose a condensing lens or pair of them between the lamp and slide. A pair of sixty-millimeter-diameter (2 2/5-inch) plano-convex condensing lenses like those mentioned in connection with the microprojector (P.S.M., Sept. 1937, p. 76) will do nicely. Place the pair (which should be purchased in a mount rather than unmounted) so that one of them is about two inches from the surface of the photoflood lamp, and the other is four or five inches from the slide. The exact distances for best illumination are found easily by experiment. Lamp and condenser should preferably be mounted on an extension of the camera base, as illustrated.

IT IS not necessary to provide a housing for the photoflood lamp, but it may be desirable to arrange some kind of a shield that will keep its rays from striking your eyes directly. If you do make a housing for it, out of a length of stovepipe or other material, be sure to provide plenty of ventilation, and to use a socket not easily damaged by heat.

Doubtless you are worrying about the kind of film to use for photomicrography. In the final analysis, it will depend to some extent on the kind of work you are doing. But, generally speaking, you will find it advantageous to use a fairly contrasty panchromatic film (or plate). Panchromatic film is sensitive to all colors of the spectrum.

(Continued on page 119)



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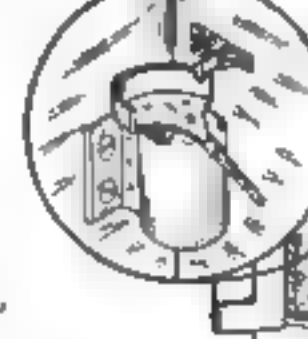


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Hook a Camera to Your Microscope

(Continued from page 118)

For work not involving red light, you may find an orthochromatic film, or even "color-blind" film sensitive mainly to blue light, equally good or better. There are on the market special fine-grained panchromatic films, which can be obtained in roll, pack, or cut form. These generally are suited to photomicrography because of their high contrast. Another good film, where extreme contrast is desired, is process panchromatic. Among the materials made specially for photomicrography are Wratten M. and Wratten metallographic plates. The M plates are sensitive to all colors of light, while the metallographic plates are not sensitive to red.

IF YOU do your own developing, it is best to use developing and fixing formulas recommended by the makers of the film or plate you are using. Make your prints like you would any other photograph, either by contact printing or projection.

And that's all there is to the making of pictures through the microscope. Fundamentally, the process is not a bit different from the making of any other kind of photograph: you merely substitute a microscope for your camera lens.

Professional types of microscopes generally are designed so that the image formed on a ground glass placed at a distance of about ten inches from the eyepiece represents a magnification identical with that observed by looking through the microscope. Therefore, if your ground glass is at that distance, the magnification can be determined directly by multiplying the power of the objective by that of the eyepiece. If you increase the distance between eyepiece and ground glass to twenty inches, the magnification (on the ground glass) will be doubled. At three times the standard distance it is trebled, and so on. However, there is a limit to how far this process can be carried, for various factors tend to fuzz up the image as the extension becomes greater.

IF YOUR microscope has a substage iris diaphragm, you will be using it to gain contrast, by reducing the size of its opening. Care must be taken not to carry this too far, or the diffraction rings and other patterns will damage or destroy the image. Excessive stopping-down is evidenced by false lines about the margins of the image, by double images, and by a general distortion of detail.

After you have mastered the fundamentals of photomicrography with an outfit like the one described, there is no limit to the extent to which you can carry the hobby. Modern natural-color films, for example, open up a vast field in the recording of stained specimens or those illuminated by polarized light.



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Flintlock Pistol Model

(Continued from page 82)

on the flashpan covers, triggers, or trigger guard, because all these are thin sections across grain, hence easy to split off. Also take care not to hurry the job. Cutting about the butt, because of the curved broadening there, must be very carefully done to avoid splitting off one side of the grip, which can easily happen.

When this shaping is completed, sketch out the two triggers within the trigger guard and carefully cut away the wood around them with the knife tip. Don't try to make big cuts or attempt to wedge out chips—either one leads to a guardless pistol. It may help considerably if you drill a number of holes through the waste wood before beginning the cutting. Shape and round up trigger guard and triggers.

BEGIN the flashpan covers by V-notching down between them until they are separated. Shape up around the foot of each, outlining the pivot, and at the same time cut out the wood around the flashpan, which looks like nothing so much as a J on its side. The wood between flashpan and hammer must be worked out with the tip of a thin-bladed penknife, and the general surface of the escutcheon plate can be reduced at the same time until it is about 1/32 in. above the surface of the grip and the pistol body.

The sketch in the circle gives the details of the hammer, although you may, if you prefer, use the alternate, commoner design shown near it. Then shape up the hammer head as if with a bit of flint in place ready for striking. Cut a V-notch between the hammer heads to give clearance for the shaping. Finish the shaping of hammer, flashpan cover and flashpan, and smooth up the escutcheon plate.

Draw a line down the center of the double barrel, and V-cut in from each side; then chamfer the top and bottom edges to form a double octagon. Smooth up the handle and butt, and use a sharp, hard pencil or a fine pen to touch in the fine outlining on hammer, escutcheon plate, and butt. Draw in the pivots and the flat spring that holds the flashpan cover open or closed, or, to be more exact, insert a piece of metal or paper to represent the spring.

The pistol may be left "as is" to show the whittling marks or sanded smooth. If a realistic effect is preferred, it may be painted in appropriate colors—silver or aluminum for the metal parts and dark brown or black for the wood. Such a model looks well mounted on a rectangular plaque, or two pistols may be made and fastened so the barrels cross on an oval plaque as illustrated on the first page of this article.

If you would like more articles on firearm models to be prepared for publication in future issues, please send a post card to the Home Workshop Department.

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Grecian Rose-Petal Urn

(Continued from page 80)

Use $\frac{1}{4}$ -in. carpenter's chisel to bore hole to take dowel of stem piece.

Assembly. Glue parts together. When dry, shape the beads of holly and vermillion on the stem. With a sharp chisel, remove the surplus white holly from the initial while the lathe is at rest. Then turn bowl down $\frac{1}{16}$ in. to finished size. Smooth well with very fine sandpaper or 000 steel wool. Sand the initial and the holly bead lightly alone, being careful not to touch the walnut, because the walnut dust would discolor the holly. French polish the urn.

The lid. Materials: 1 pc. walnut 2 by 4 by 4 in.; 1 pc. walnut $1\frac{1}{2}$ by $1\frac{1}{2}$ by 3 in.; 1 pc. vermillion 1 by 4 by 4 in. Turn the first piece to a diameter of $3\frac{3}{4}$ in. and to the shape shown. Drill a hole $\frac{1}{2}$ in. in diameter, $\frac{3}{4}$ in. deep. Smooth with sandpaper.

TO MAKE the rim that encircles the bottom of the lid, mount the vermillion on a screw center and turn to $3\frac{3}{4}$ in. diameter. Remove the center of the circle to a depth of $\frac{1}{2}$ in., leaving a rim $\frac{1}{2}$ in. in width. Fit the lower part of the walnut lid snugly into this rim of vermillion, glue it, and sand and finish in the usual manner. With a parting tool, sever the vermillion from the bottom of the lid, leaving only the $\frac{1}{2}$ in. wide rim.

Make the upper part of the lid from the smaller piece of walnut and glue the two parts of the lid together. Sand and French polish.

Handles. Transfer design on $\frac{3}{4}$ -in. thick walnut. Scroll-saw the outside only. Fasten each piece to a block of wood with brads through the waste that is to be cut away later. Hold the block in a vise and carve the design to a depth of about $\frac{1}{8}$ in. on each side. Scroll-saw the inside of the handle, sand the raised portion, coat with thinned shellac, and when dry wax with floor wax.

Mark position of handles on bowl so the initial will come midway between. Scrape the place of contact, glue the handles, and bind with cord until dry.

Finishing. Glue green felt to bottom of base. Give the urn several applications of floor wax and polish with a soft cloth after each.

Rose-petal recipe. Gather flowers in early morning, throw lightly on a table in a cool, airy place to dry, then put in a jar in $\frac{1}{2}$ -in. layers, sprinkling a little fine table salt on each layer. This is done from day to day. Stir and shake to get a better mixture, and continue until the jar is filled. Mix 1 oz. powdered orris root, $\frac{1}{2}$ oz. allspice and cloves, $\frac{1}{4}$ oz. mace, half a grated nutmeg, $\frac{1}{4}$ lb. dried lavender flowers, a few tonka beans and cardamom seeds. The urn is then filled with alternate layers of the rose-petal stock and the mixture of spices. A few drops of essential oils, such as rose, geranium, orange flower, or bitter almond, are dropped on the layers as the work progresses; and on the whole mixture pour 1 oz. of eau de cologne.



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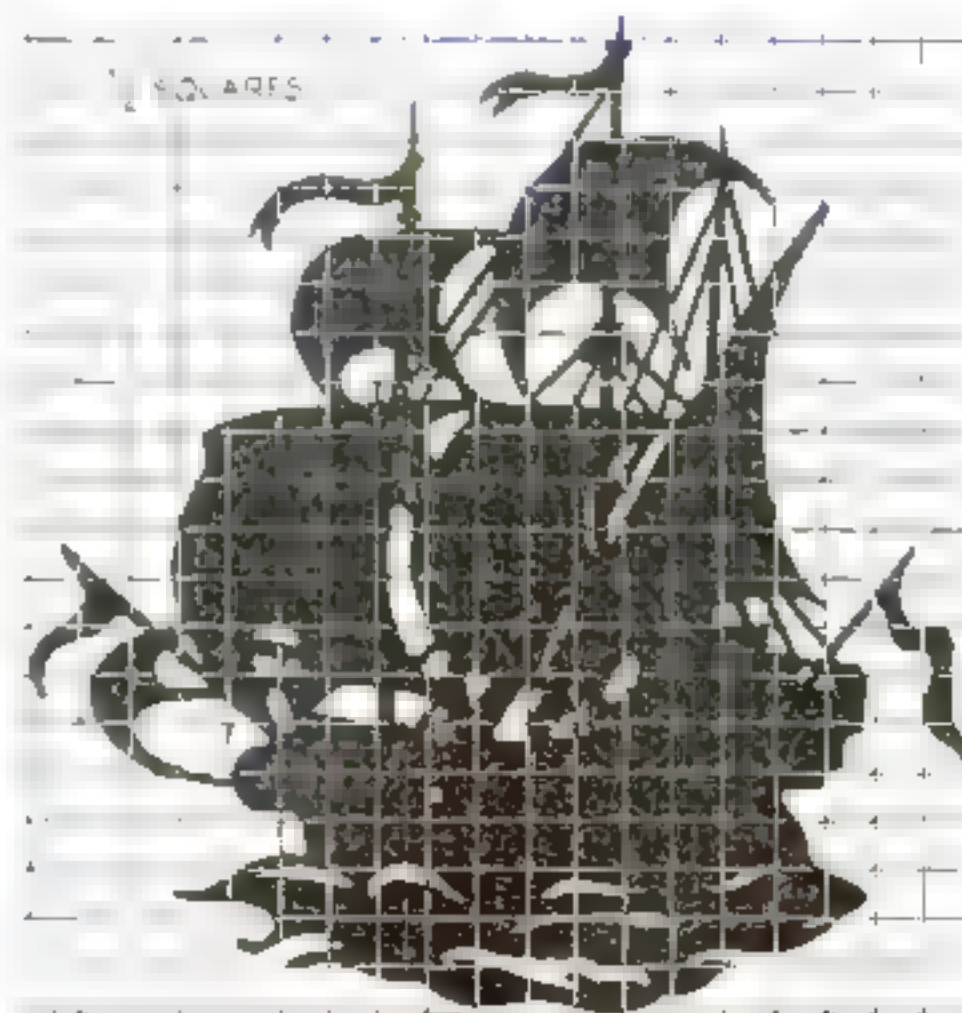
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A Jig-Sawed Galleon

(Continued from page 84)



Pattern for plaque drawn on $\frac{1}{2}$ -in. squares

cord and tassel for hanging on the wall.

The plaque was submitted by the Hyattsville (Md.) Woodworking Club in a three-hour project contest of the National Homeworkshop Guild (see P.S.M., July '37, p. 82) and won honorable mention.

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WHEN, after machining is finished, blowholes and other foundry defects appear in metal castings, drill a hole of sufficient diameter and depth to remove the defect, measure the diameter of the hole, and make a plug 0.003 in. larger in diameter. Pack the plug in "dry ice" until it shrinks to the size of the hole and drive it in place.

If a plumb line has to be dropped from any great height, leave the plumb bob suspended in a glass jar filled with light oil. This will steady the plumb.

To make sure that a file is acting upon the desired spot when filing cylindrical work or a piece of uneven contour, rub chalk on the file. The result will be a chalk mark on the work adjacent to the point the file contacts the work.

When making taper-shank tools, arbors, and mandrels, don't neglect to turn recesses and reliefs adjacent to the centers and ends. Hammering on the ends when removing such tools from the machine will not harm the centers or periphery if such provision has been made.

Various cutting tools are sold that have such advantages as shear cut or alternate teeth at opposite angles. In purchasing these, ask yourself this one important question: In my case, is the cost of grinding these tools going to offset what I gain from their greater efficiency.

Where possible, it is always good policy to stamp on tool-steel parts the name of the steel used. They may have to be annealed and heat treated at some future date, and the steel manufacturer's recommendations for that particular steel will be necessary.

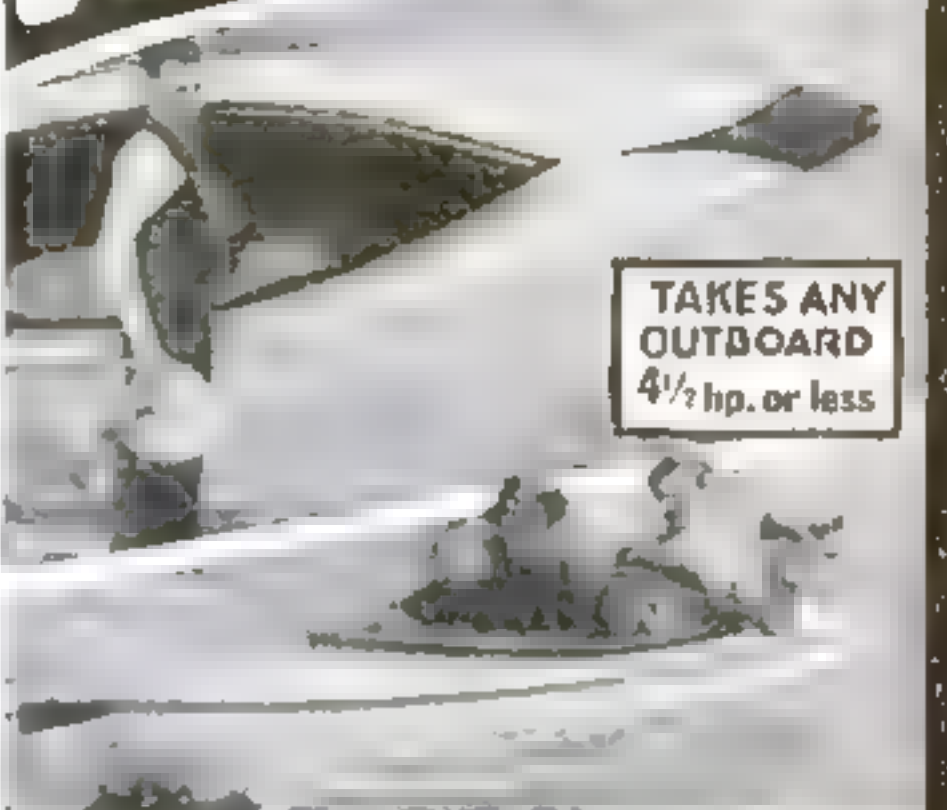
A file that appears hopelessly loaded with metal particles, or one of such fine cut that the wires of a file card will not enter the space between the teeth, may readily be cleaned by holding a piece of 1/16-in. sheet brass at about a 45-deg. angle with the surface of the file and pushing it across the file parallel to the direction the teeth are cut.

To determine the thrust on a lathe tail-stock center when a piece is held between centers, multiply half the weight of the piece by 0.5774.

In drilling phenol-formaldehyde compositions, an ordinary drill invariably breaks the surface at the point of entry and exit, leaving a ragged appearance on the finished work. The solution is to grind the drill point to an acute angle. A 60-deg. included angle has been found to be most satisfactory.

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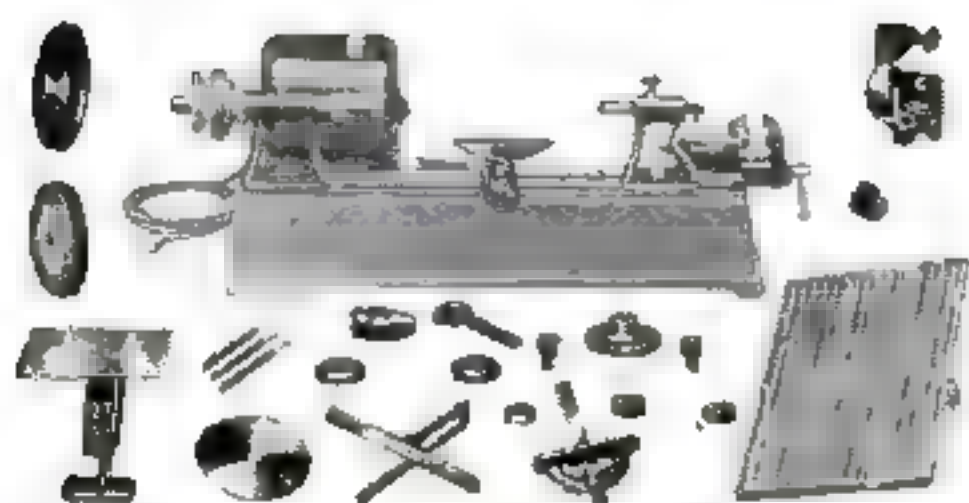
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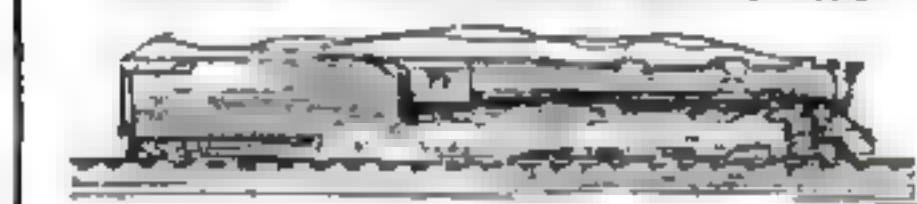
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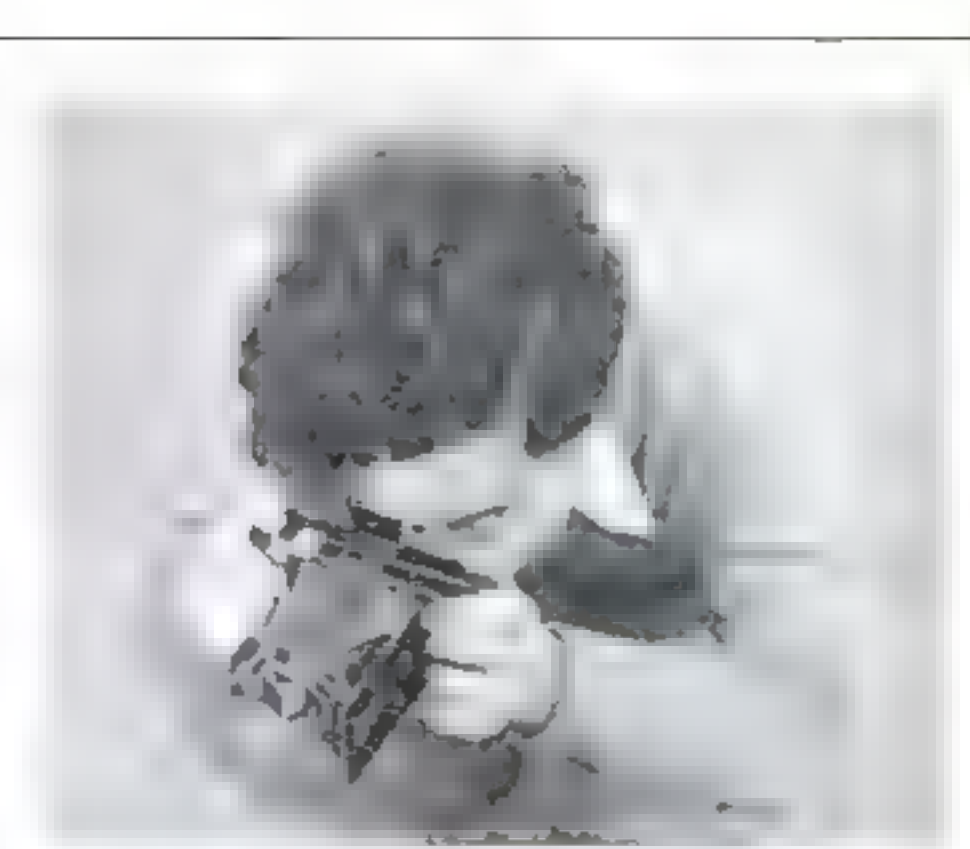
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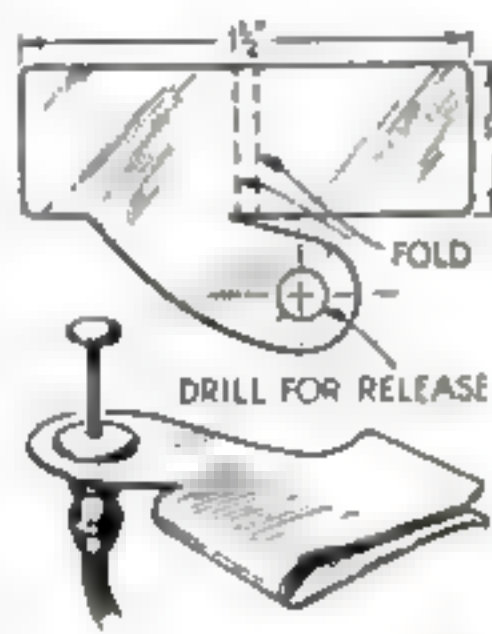
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A Nonjarring Release for Camera Shutter

ONE fundamental rule when taking pictures is to hold the camera steady as the exposure is made. This is difficult when using a small camera with a direct-view finder. Some of the latest cameras have a device to prevent jarring—a finger-tip release built into the camera body. This type of shutter release enables the camera to be held firmly by both hands, only one finger being required to release the shutter. A similar release can be made as shown.

Cut a piece of about 18-gauge metal to the size of the pattern. Drill a hole large enough to take the top of the cable release. Round all edges with a file and fold the metal to leave enough space so that it can be slipped on and off the camera body easily and still



A sheet-metal clip is made to hold the button on the camera

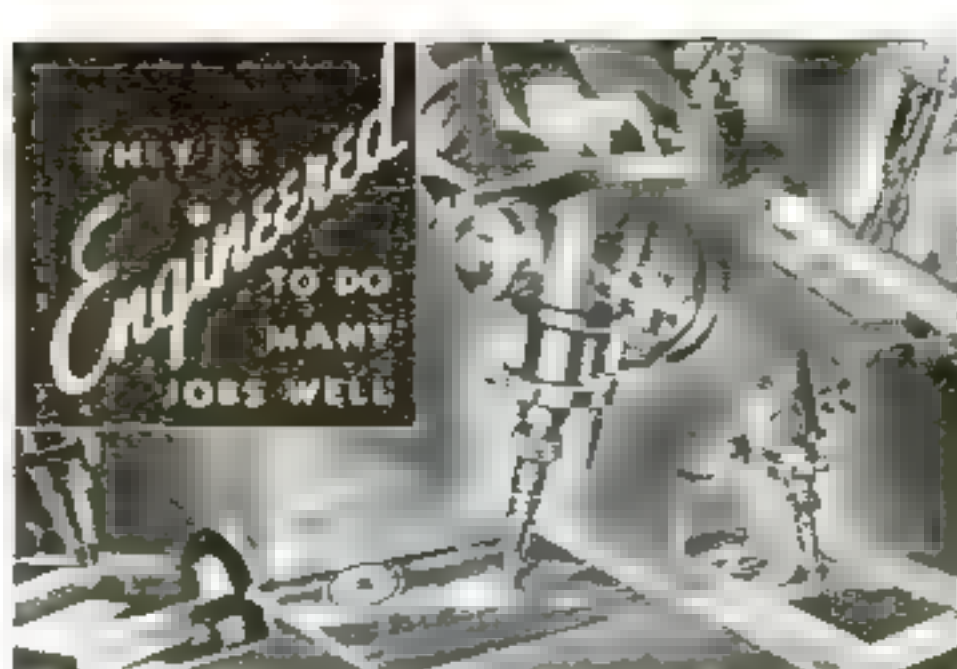


be tight enough to resist the downward pressure exerted when an exposure is made. Slip the cable release through the hole in the metal. If necessary, the release may be fastened to the metal with a drop of solder.

When held as shown, this one-finger release will help greatly in keeping the camera steady.—WALTER GOTTLIEB.

Filing Small Negatives

It is important to store photographic negatives so they will not become scratched, but most commercial negative files are quite expensive. A cheap cardboard or metal box meant for filing ordinary 3 by 5-in. index cards will accommodate several hundred small films. The negatives are put between the cards, and the title, exposure, and other data may be written on each card. This keeps the films flat and protects them from dust.—H. V. L.



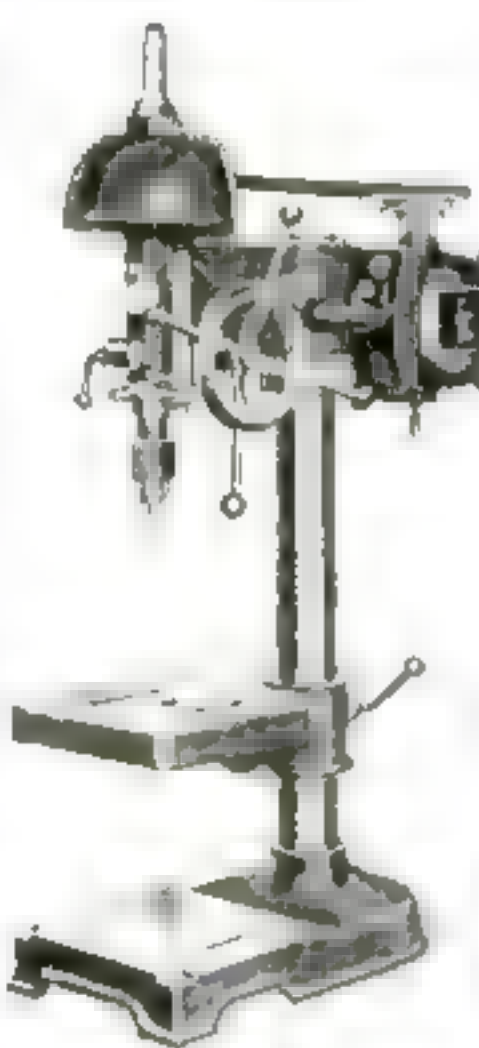
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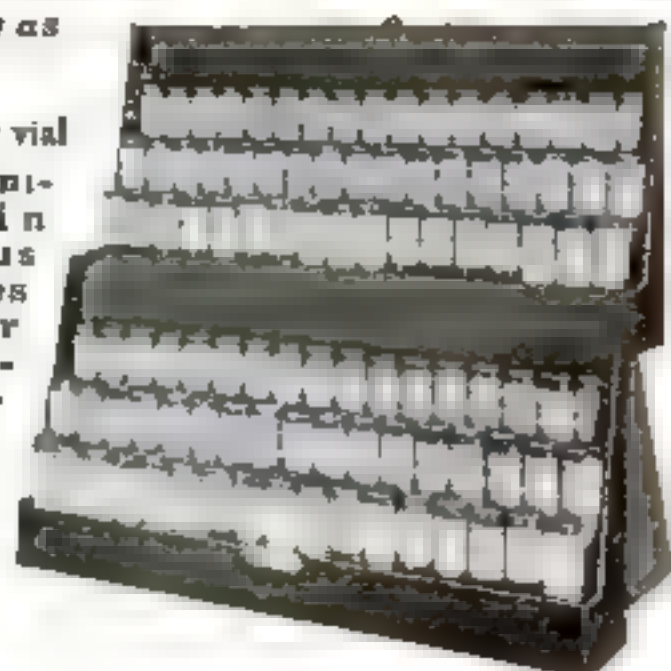
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Stunts with a Glass-Eating Chemical

(Continued from page 99)

as it slowly warms up. At a certain temperature, it will begin to shine of its own accord. The effect can be seen most plainly with the gas flame extinguished, or with an electric heater that does not glow visibly. A purple or blue crystal works best for the experiment, which may be performed repeatedly without damage to the crystal if you do not heat it so fast as to cause internal strains that would shatter it.

FLUORIDE in a homelier form may be more readily accessible, for roach poison usually contains this chemical. If it does, you can mix the insecticide powder with strong sulphuric acid and perform experiments like etching glassware with it. Even without reading the label of the carton, you can readily detect the presence of a fluoride in the preparation.

To do this, place some of the powder in a test tube with a pinch or so of sand. Add some strong sulphuric acid. Heat the test tube, doing so gently, since the preparation may contain ingredients that would otherwise cause frothing and spattering. A drop of colorless ammonium molybdate solution, suspended meanwhile at the mouth of the tube on a rod of glass or hard rubber, will turn yellow if the compound contains a fluoride. An even simpler test, however, can be made merely by holding a drop of plain water on the rod. When a fluoride is present, the drop of water will turn milky.

This results from an interesting chemical reaction. First, the fluoride in the insect powder reacts with the sulphuric acid, and hydrofluoric acid is formed. The hydrofluoric acid thereupon interacts with the sand, which is an oxide of the element silicon. Fluorine from the acid and silicon from the sand combine to form the rather remarkable gas called silicon tetrafluoride. The same gas, incidentally, is formed when hydrofluoric acid attacks glass, which is chemically a mixture of silicates of calcium and sodium.

Can you stretch your imagination for a moment and visualize, if you are able, such a thing as "sand gas"? Chemically speaking, silicon tetrafluoride might answer to such a name, for when the colorless gas comes in contact with water it promptly forms silicic acid, a compound closely akin to sand. This white substance, silicic acid, is what turns the drop of water milky in the test for a fluoride.

YOU can manufacture "sand gas" or silicon tetrafluoride on a larger scale and explore its odd properties with a little simple apparatus. To generate the gas, place in a chemical flask some fluor spar, calcium fluoride, or sodium fluoride. Add about the same quantity of ordinary river or building sand, or the purer white bird-cage sand or

gravel. Powdered glass may be substituted for the sand if you prefer. When all is ready, pour in about a fluid ounce of strong sulphuric acid and heat the flask gently with a Bunsen burner, an alcohol lamp, or a small electric heater. The hydrofluoric acid that is liberated will react with the sand or glass to form silicon tetrafluoride gas. You need not fear that the acid will ruin your glassware or damage it in any way. To make sure that all of it is transformed into silicon tetrafluoride, a wad of glass wool or glass fiber, of the kind sold for ornamenting Christmas trees, may be placed in the flask above the reacting mixture.

FROM a one-hole stopper in the generating flask, lead the silicon tetrafluoride gas through bent glass tubing into a second flask or bottle. This empty vessel serves as a trap to catch any water, froth, or foam that might be carried along with the gas. An ordinary flask or bottle with a two-hole stopper, or a flask with a side outlet and a one-hole stopper, may be used. Finally, the gas is led from the outlet of this vessel to a third one, a wide-mouth bottle through which the silicon tetrafluoride circulates and then escapes into the air.

As the silicon tetrachloride meets the outside atmosphere, it will be seen to fume. The white cloud that forms around the outlet of the wide-mouth bottle is actually a miniature sand storm, consisting of particles of silicic acid. Floating lazily in the air as they do, these particles must be almost inconceivably small. They are produced because the air contains moisture or water vapor, and the silicon tetrafluoride gas turns to the sandlike white material when it comes in contact with water.

In case you have failed to put together your apparatus carefully enough, and it is not gas-tight throughout its length, the silicon tetrafluoride gas will turn detective and locate the leaks. Wherever the gas escapes into the air, during an experiment, you will see a telltale white sandstorm; and if tubing is not well fitted to bored corks, the leaks will become encrusted with the white deposit. Here is a picturesque test, then, by which you can check your skill at handling the tools of chemistry.

YOU can perform a curious and striking experiment with silicon tetrafluoride gas by gluing a small glass vial to a square of cardboard, so that it will stand upright when set down. Attach a little wire bail or handle to the vial, so it can be handled with a hook bent from a fragment of wire, and fill it with water. Then lower the vial into the wide-mouthed bottle of your gas apparatus, and let the bottle become filled with silicon tetrafluoride gas. In a few sec-

(Continued on page 127)

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Thrilling Stunts with a Glass-Eating Chemical

(Continued from page 126)

onds, you will see the surface of the water becoming coated with a frosty layer of white silicic acid. After a short time, remove the vial with a wire hook. Try to pour out the contents. You will find the vial so tightly corked with the plug of silicic acid that the water will not spill out, even when you hold the vial upside down!

If you let silicon tetrafluoride gas bubble from glass tubing immersed in water, the end of the tubing, likewise, soon becomes tightly sealed by the precipitated silicic acid. This may be avoided by discharging the gas into a little pool of mercury, at the bottom of the dish, so that the bubbles of gas will rise through the mercury before they come in contact with the water above it. Then you can collect the silicic acid, which is quite pure, after the gas has been passed through the water for some time.

O PEN the mouth of an inverted, wide-mouthed bottle of silicon tetrafluoride gas under water, and at once a partial vacuum will be created within the bottle. The speed with which water rises shows how readily the gas dissolves in and interacts with it.

The same reaction you have been using to prepare silicon tetrafluoride gas makes fluoride compounds valuable in metallurgical operations. To free ores of undesired silica, or sandlike compounds of silicon and oxygen, they may be "fluxed" or fused with calcium fluoride. The silicon combines with the fluorine to form silicon tetrafluoride, which escapes as a gas, while the calcium and oxygen form lime. From the pasty slag or residue of lime and other impurities the metal is easily separated.

POPULAR SCIENCE

Question Bee

SEE how you made out in the questions on page 60. The letters alongside the numbers below indicate the correct answers. Give yourself four points for each one you had right, and add up your score. A total of 80 to 92 is good, and from 92 to 100 is excellent.

QUESTIONS

- | | | | | |
|------|-------|-------|-------|-------|
| 1. a | 6. b | 11. b | 16. b | 21. b |
| 2. b | 7. b | 12. b | 17. b | 22. c |
| 3. e | 8. c | 13. a | 18. a | 23. d |
| 4. a | 9. b | 14. c | 19. b | 24. b |
| 5. c | 10. c | 15. b | 20. b | 25. c |

PICTURES

- | | |
|----------------|-----------------|
| 1. auger bit | 7. hand saw |
| 2. try square | 8. plane |
| 3. twist drill | 9. gimlet bit |
| 4. bit brace | 10. chisel |
| 5. back saw | 11. gouge |
| 6. countersink | 12. nail hammer |



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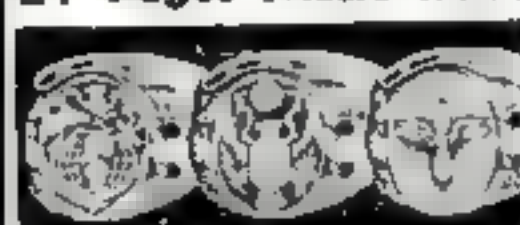


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Piercing Punches and Dies

(Continued from page 90)

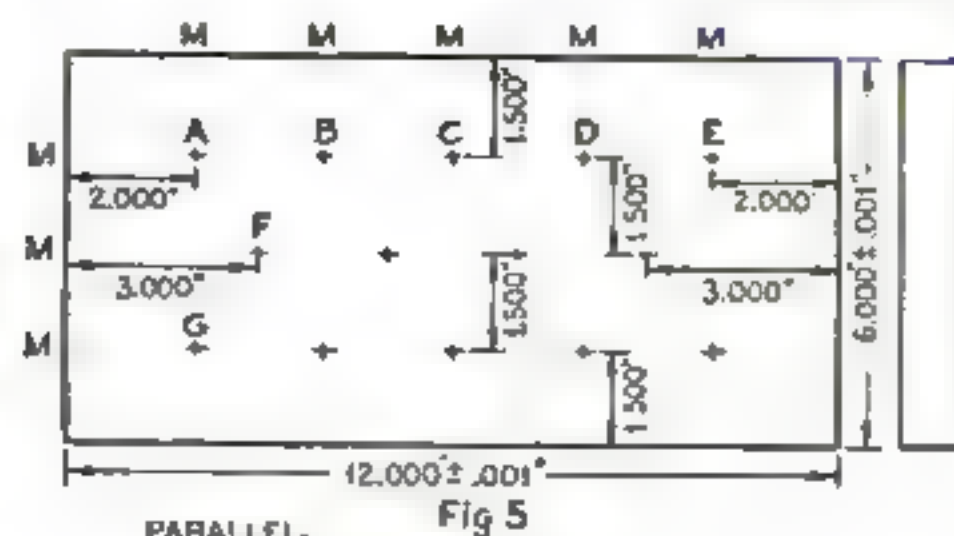


Fig 5

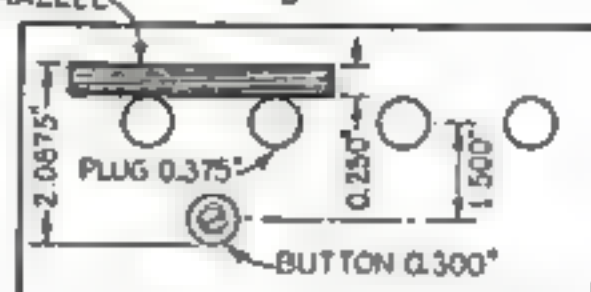


Fig 6

Method of locating button screws in plate

and the work must be well balanced.

The plates should be surface ground after shaping, strapped in pairs and ground accurately square and to size on the sides. After laying out and tapping holes for the button screws, 3/16-in. holes should also be tapped on the sides at convenient places to locate the buttons as shown in one of the photographs. Small parallels of standard thickness are made for this, and the die maker should have at least six.

If the job requires more than four buttons, another set should be borrowed to complete the layout. With lathe boring of this kind, it is advisable first to locate completely. This expedites the work to a marked degree and insures the utmost accuracy, providing the buttons are securely screwed, the assembly carefully checked, and all conditions related to the lathe, as previously outlined, are favorable.

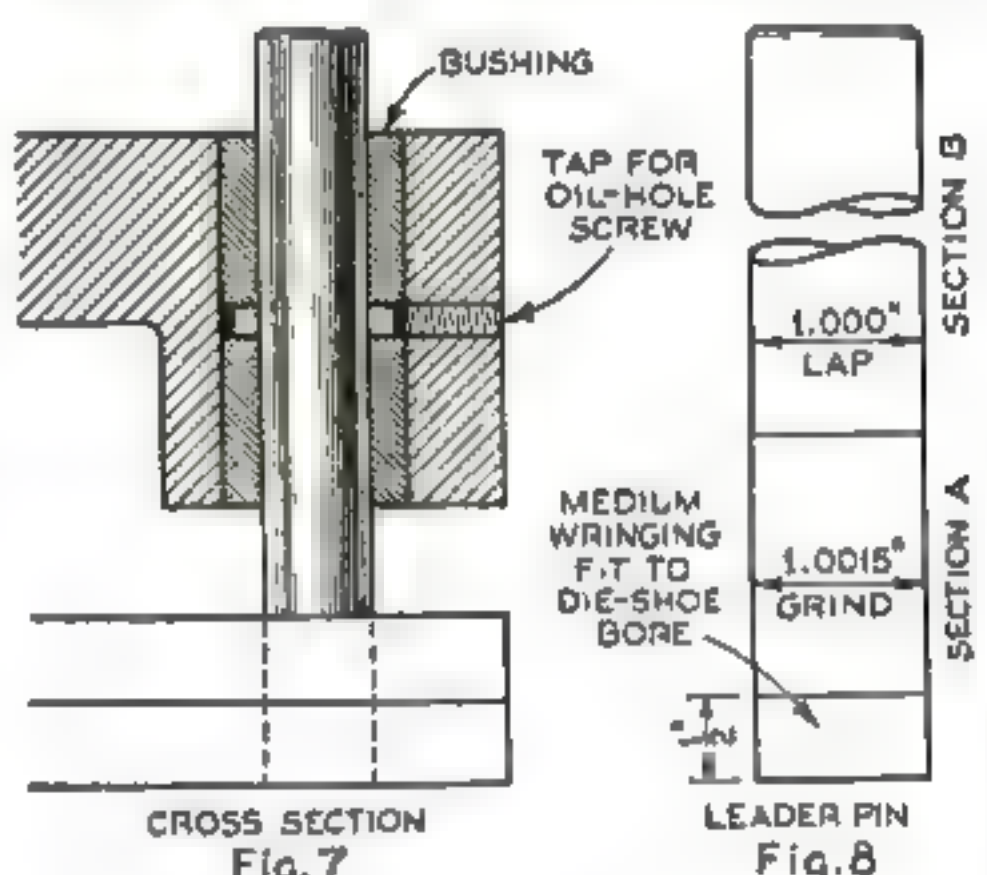
Plates requiring a vertical boring attachment should be very accurately squared to size in pairs in the shaper and then surface ground. The procedure for locating the buttons is the same as just described and as shown in Fig. 5. For this particular job eight buttons should be used. Eight 3/16-in. holes should also be tapped for small parallels at the points marked M. Buttons A to G may then be quickly located, and the first plate is ready to be drilled and bored, after making proper adjustments on the table of the milling machine.

After the holes A to E are finished, the three remaining holes on the middle line are located by working from F transversely, and transversely from A, B, and so on, as shown in Fig. 6. The set-up is repeated for the four holes in line with G. The plates should be marked before boring so the locating can be started from mated sides. The results should be excellent if the boring equipment is top notch; if not, it's the old story of bore-and-try, and that's slow work.

Some shops buy die sets complete; others prefer making their own leader pins and bearing bushings. Besides making the bearings much larger in die sets these days, changes have also been made with pins and bearings. Leader

pins are now made without grooves, and the bearing bushings are made in two parts so to create a centrally located oil chamber as shown in Fig. 7. This produces an ample bath of oil, with the leader pins retaining a full bearing surface. These parts should be made of correctly selected, straight carbon steel, the die bushings and punches of oil-hardening die steel, with manganese governing the analysis. Punches should always be made with male centers as they are more easily ground off. Conventional centers in punches are often the cause of hardening fractures.

It is up to the grinder hand to fit all these parts into their proper locations. His job is as important as that of the die maker. When fitting the leader pins to the die shoe, one can rely on a 0.0015-in. drive as standard, and have no fear that they will ever move. Of course, the bores in the shoe should be carefully checked and, as shown in Fig. 8, a 1/2-in. section should be ground a medium wringing fit to the bore; then use the recommended 0.0015-in. straight drive on the remainder of section A. A tapered drive should never be used with die work. Section B should be ground 0.0002 in. oversize because a lapping operation is advisable to remove the premature wear. A similar allowance should be made for the bores of the bushings; however, the lapping should



CROSS SECTION
Fig. 7

LEADER PIN
Fig. 8

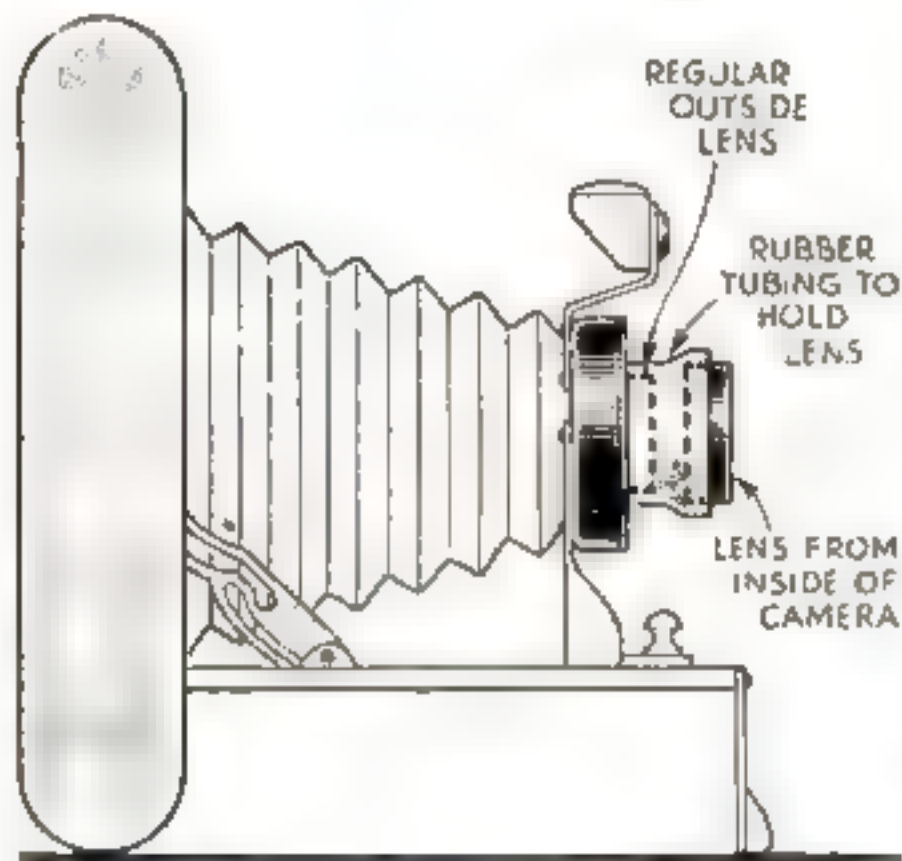
The bushings are made in two parts so as to create a centrally located oil chamber

be done only after pressing them into the punch holder. It is hardly necessary to add that the 0.0015-in. drive also applies in this case, as well as to punches and die bushings. Nevertheless, set screws are sometimes used to hold punches, in which case a 0.0005-in. drive is sufficient. As to the correct clearance between punch and die to obtain the desired size hole, this is predetermined, so one must go by the drawing figures.

After all, accuracy with piercing punch and die making is not such a hard problem, if the equipment is close to par. All tool work is highly specialized now. It's every man on his own job, and he usually knows his stuff. I have always hated to see a die maker "take the rap" for a stripped job because of an out-of-joint press.

Small Objects Photographed by Shifting Inner Lens

TO ILLUSTRATE some magazine articles, I found it necessary to take a number of close-up photographs of various small objects. Even with a portrait attachment on my inexpensive folding camera, it was difficult to get satisfactory pictures. Then, to try out a theory I had, I reversed the two lenses in my camera—that is, I took the camera apart, unscrewed the lens on the inside, made a rubber ring so that it



The inner lens is temporarily used in front

would fit on the front of the camera, and fastened it as shown in the accompanying diagram.

To find the focal length, I attached a piece of ground glass to the field of the camera and moved it toward the object until the image was very sharp. After the distance (in this case, 15 in.) had been measured exactly, I took the pictures just like any indoor shots. There was no noticeable distortion.

A little experimenting showed that by moving the reversed lens an inch away from the camera, I could take pictures of objects only 9 or 10 in. away. Of course, cameras differ. In trying this stunt, you will therefore have to do your own experimenting and make charts for distance, the amount of light, the shutter opening and the exposure time in order to get perfect photographs.—W. J. G.

Loosening Small Drill Chuck

THE drill chuck on my polishing head became so tight while being used that I found it difficult to loosen the drill by hand and frequently had to resort to a wrench. To avoid this, I glued two pieces of fine emery cloth, about 2 by 4 in., back to back. Wrapping this around the chuck gave me a perfect nonslip grip, even if my hands were moist. The method is equally useful for loosening tight jar caps.—ROBERT E. RUSCH.

Making Stepladders Last Longer

WHEN a new stepladder is purchased, it pays to apply two coats of high-grade outside paint, which will help preserve the wood. Keep all the screws and bolts tight, and the ladder will do service for years.—ARTHUR L. KASER.



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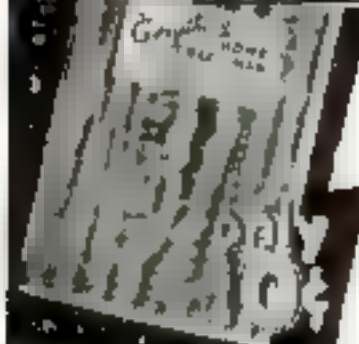
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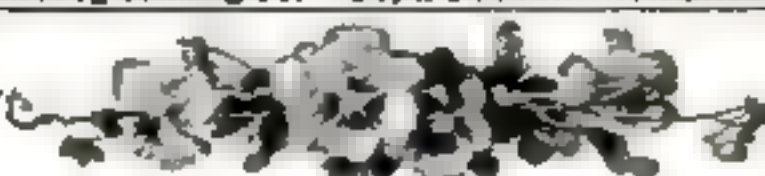
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Mineral-Water Gushers Create Boom

(Continued from page 43)

lie on top of each other like a stack of soup plates. Some of these layers are much harder than others. It is believed that the stratum where the Munkacsy water was struck is relatively porous with hard layers above and below. The pressure of the water pouring through this porous layer from the sides forces the fluid up the pipe in the form of a flowing well. Mineral salts absorbed from the ground give the water its unusual and valuable characteristics.

A STUDY of the drillings shows that, for about ten feet, the machines bore through soil deposited by the river. At this depth, they strike the first layer of brown stone or crumbly shale. This continues for about 100 feet. At approximately 150 feet, the drill bores into "pay dirt," the dark rock from which the health water flows. In putting down his wells, Parkhurst makes it a practice to drill to the brown-stone stratum and then run down a casing and embed it in the rock before continuing. This procedure keeps out surface seepage.

Two houses down Lane Road from Munkacsy's, a neighbor, A. S. Biczak, has taken no chances. He has put down a \$2,000 well which taps water at four levels. Telescoped one inside the other are four pipes, ten, eight, six, and four inches in diameter. The ten-inch pipe goes down only sixty feet; the four-inch one nearly 500. Comparative chemical tests are now under way to determine the proportion of minerals in the water from the different levels under the ground.

On the first week-end after Biczak's well began producing, the owner sold 1,000 gallons of water at fifteen cents a gallon. In fact, with several wells in operation, a mineral-water war is in full swing. Huge signs and brilliant banners vie for attention and proclaim the virtues of the different springs.

Over the road in front of Munkacsy's stretches a twenty-foot banner warning: "Demand Munkacsy Red Cross Health Water." A billboard, even larger, reads: "The One! The Only! The Original! Munkacsy Red Cross Health Water. Do Not Accept Inferior substitutes!" Ahead, down the road, other signs proclaim the main entrance to "Water of Youth, Inc."

ON THE other side of the Passaic, in a cow pasture, Warren Daniel is obtaining water with a distinct sulphur taste. This may prove valuable for treating skin maladies. The Munkacsy water is virtually tasteless. When Daniel's water came in, he tried out the capacity of his well by installing a centrifugal pump which drew off 110 gallons a minute. For eighteen hours, it poured out a flood of water. When the test began, the water level of the well was two feet above the ground. During the pumping, it dropped to twenty-one feet below the surface. Here it remained stationary as long as the

test continued. This fact led to the conclusion that the basic supply of water is almost limitless.

A few days before I visited the location of this strange mineral-water boom, Munkacsy leased his well to a Newark, N. J., syndicate. This concern is marketing the water as far away as Miami, Fla. It plans to keep a fleet of trucks carrying the bottled fluid on regularly scheduled runs. By next spring, it is estimated, there may be as many as fifty wells draining off the mineral water from the valley basin. Lots, fifty by 200 feet, sold as late as a year ago for \$300. Today, it is reported, owners are refusing offers as high as \$5,000 for the same pieces of land.

CURIOSLY enough, it was water that brought John Munkacsy to America from his native Hungary more than twenty years ago. He holds half a dozen engineering degrees from Hungarian schools, and was educated in the best universities of that country. Just before the World War, the Hungarian Government sent him to the United States to study the water-supply system of New York City. He was here for a year and had just completed his work when the war broke out and left him stranded in America.

For a while, he worked in an electrical supply factory. Later, he opened the first radio store in Passaic, N. J. Now he owns a shop in Newark where he makes models for inventors. The spot on the south bank of the Passaic River where the mineral water was struck, was purchased more than a dozen years ago. He was making a motor-boat trip up the river one Sunday afternoon with his wife. She was struck by the beauty of the spot and they decided to buy the land. Incidentally, it was Mrs. Munkacsy who decided upon the location of the new well which has brought them riches.

SO FAR, only the initial chapter in the story of this unusual development has been written. Already, however, it has provided the quiet community with more excitement than it has experienced since the early days of the present century, when gold was discovered in the Towaco hills, five miles to the north. That boom collapsed because the small concentration of the precious metal in the sandy gravel made it unprofitable to mine. But the new health water, flowing from the depths of the ground in a seemingly inexhaustible supply, promises a novel and steady source of wealth.

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JIFFIE-VISE



In the cutting room, sound tracks carrying the voices and effects are matched with scenes

Putting Fairy Tales on the Screen

(Continued from page 52)

near-by, and recorded the series of bumps and crashes as they tumbled to the floor. Later, artists, listening to a play-back of the sound track, matched it bump by bump, the pictures being drawn to synchronize with the noises. Breaking glass later was matched when two men dropped a large pane eight feet from a ladder to the floor.

Other actions called for in the script complicated the sound men's job. How would a talking mirror sound? What kind of noise would seven dwarfs make when eating soup—and, more important, how could the noise be represented on the sound track? Posers, these problems; but ingenious magicians with sound solved them.

IT WAS decided that should a mirror ever actually speak, there would emerge from its silvered surface a sepulchral, masculine voice. For weeks, voices were recorded in boxes, through sheets, before sounding boards. At last a sound technician hit upon the idea of building a square box with old drum-heads stretched taut over five sides, leaving an opening in the sixth. Through that opening an actor placed his head, spoke the prescribed lines into a near-by mike, and became the talking mirror.

As for the soup, seven studio workers sat at a table for a day and a half, intermittently sipping malted milk and eating wafers. Short, quick "slurps" represented tenor parts; long "slurps," bass.

When the dwarfs washed their faces and sang, seven men skilled in the recording of unusual sounds stood around a water tank the size of five bath tubs, alternating washing their faces and dipping their heads into the water, singing at times while their faces were submerged. The underwater sounds being recorded by a shielded microphone. And to represent a character slushing through a fanciful swamp, the tank was filled with mud, and a man walked in the mud several hours, in tempo with a metronome whose tick-tick came to him through earphones.

Meanwhile, application of color, which

(Continued on page 132)

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Putting Fairy Tales on the Screen

(Continued from page 151)

has achieved great perfection in cartoons, has become as mechanical as the creation of sound effects. For a full-figure shot, Snow White appears in fifteen tints, selected from among 350 standard colors available in the studio paint shop. These vary from tint 685 1/2 (yellow shoes) to pastel 23 (cheeks). When she sings, six colors are added to her eyes and mouth for close-ups, these ranging from orange-yellow on the lids to light red for the lips. Upon each drawing is noted the particular colors to be added to the several areas, and thereafter scores of girls complete the many paintings by spotting colors according to number.

PAINTINGS on three to seven cels appear in a single shot, the number depending upon the action and characters. In its simplest form, usually four cels are used.

Suppose Snow White is photographed singing. For this sequence, provided her figure is to move, the lowest cel contains the "setting," perhaps a wall of the house. Next above appears her body, minus arms and head.

To show the necessary movements, which match the song recorded several weeks earlier, two cels, one containing a painting of her head and the other

her arms, are placed in series above her body. After each exposure, new cels are put in to take the place of these.

This process continues for perhaps sixty frames, enough to complete a well-rounded word. Projected at standard speed of twenty-four pictures a second, the many paintings blend to create the necessary illusion of motion in color.

ONCE past the animation stage, which consists of completing the multitude of drawings representing whole and part figures, making the cartoon was largely mechanical, although requiring a precision found in the finest machine manufacture.

"Ink and paint" represent the manufacturing bottle neck, for a movie cartoon can progress no more rapidly than skilled hands complete the multitude of drawings. Since this cartoon required an average of twenty-two individual painted cels for each foot of completed picture, 166,352 finished paintings were exposed to the camera.

These moved at the rate of ninety feet of film daily through the camera, which, requiring 1,960 paintings every twenty-four hours, represent the world's biggest and most exacting job of painting.

How Rain May Cause Earthquakes

(Continued from page 97)

upon millions of tons of rock which this one river has shifted from the crust blocks of the continent to the blocks of the sea bottom, you can see clearly why the sea bottom must sink as it gets heavier—and why the dry land and mountains must rise and float higher as they are stripped of their rock by the rain-fed rivers.

If this change of position took place gradually, according to the proponents of the theory we are considering, there would be no earthquakes. However, this is not the case. Instead, the strain caused by shifting weight is built up over long periods of time, until the difference in buoyancy between adjoining crust blocks becomes too great. Then the blocks slip along a crack, or "fault," as the geologists call it, and the resulting vibrations work havoc on man's buildings, bridges, and other structures.

THE gradual development of strains between two blocks of the earth's crust, and the sudden shock of the resulting earthquake, can be reproduced in miniature by means of the apparatus shown in the photographs.

The mountain block and the sea-bottom block were shaped in one piece from modeling clay. Then they were cut apart along a straight line, and the

two sections balanced upon the two pans of a light beam scale of the kind used for weighing photographers' chemicals. The cut is the fault, or crack, along which the earthquake slip will take place.

The cut surfaces are arranged barely to clear each other, and the two parts are put in balance by hollowing out the under side of the mountain and filling the ocean with water.

WHEN the two pans of the scale balance approximately, sprinkle a small handful of coarse, white sand upon the mountain and its seaward slope. This will throw the scale out of balance again, but you can level it by sprinkling more sand into the hollow of the sea bottom.

Now, with the mountain and sea-floor rocks presumably floating in balance in the asphalt rock ocean, you are ready to see what torrential rains and river erosion will do toward causing an earthquake.

To provide the equivalent of a million years or so of rainfall, fill a rubber-bulb plant sprayer with water and squirt it down upon the mountain peak. Gradually, you will see the sand being washed down the slopes of the mountain toward the sea. It will soon be washed

(Continued on page 153)

This One



J2NJ-33D-9JPB

How Rain May Cause Earthquakes

(Continued from page 132)

right across the fault, or crack between the clay blocks. It probably will take only one good, long squeeze of the bulb to wash over enough sand to make the ocean block go down, and the mountain block rise. The shock that accompanies the shift represents the earthquake.

When a real earthquake occurs, geologists look for the fault, or crack, along which the slip has taken place. Where one block is pushed above another, the break is called a "fault scarp," and curious effects may be noted.

One of the most remarkable faults in the world is the San Andreas, lying diagonally across the peninsula on which the city of San Francisco is situated. Responsible for the great San Francisco disaster and many smaller disturbances, it is unusual in that the movement along it is horizontal instead of vertical. Fences and other structures that crossed it have been moved for several feet, and a house built exactly on the crack was torn in two, and the halves left standing some distance apart.

Improve Your Set with This Ten-Meter Converter

(Continued from page 103)

locate the ten-meter amateur band. With the coils as specified, this band should be spread over approximately the full scale of the converter tuning dial. If no signals are heard, test for oscillation and "tracking" by touching the fixed plates of the tuning condensers with the finger or a metal object such as a screw driver. If the oscillator is working, a loud click should be heard in the loudspeaker. Good tracking between the oscillator and input circuits is indicated by loud clicks when the mixer condenser plates are touched or the antenna wire is connected or disconnected. If you live near a busy street or highway, you can easily check the tracking by listening for automobile ignition noises. If the two circuits do not track evenly over the dial, or if the stations can be brought in at one end of the scale only, stretch out or press together the turns of either the mixer or oscillator coils or both until reasonably accurate tracking is obtained. When the proper adjustment has been located, only a slight readjustment of the mixer trimmer condenser should be required when tuning from one end of the scale to the other. It is best to make the initial tryout of the converter in the daytime, as twenty-eight-megacycle stations are usually received best during this period.

While any type of antenna may be used with the converter, the doublet variety with a twisted pair of lead-in wires will be the most suitable where automobile ignition or other man-made noise is prevalent.

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How Good Are The New War Machines?

(Continued from page 27)

wear military uniforms—a fact that some of the advocates of the ruthless use of air power forget when they talk of air attacks terrorizing civilians into meek submission.

Japanese air attacks on Chinese cities have had the same results as the rebel bombings of Madrid. They have killed many civilians, and have caused terrible suffering, but they haven't punished the Chinese into asking for peace.

WHEN used against armed forces in the Spanish war, the airplane has proved itself to be a valuable, but not a decisive weapon. Loyalist planes attacked a motorized and partially mechanized rebel column advancing on the town of Guadalajara in weather so bad that the tanks and trucks bogged down the moment they left the road. The resulting battle was the closest thing that the world has seen to the oft-predicted war of machines, and it was a decisive victory for the airmen, who bombed and machine-gunned the unlucky column to almost complete destruction. But against the intrenchments of Madrid repeated air attacks have been fruitless. Under certain favorable conditions, airplanes may win battles, but most military experts now agree with Germany's hard-headed General Ludendorff in his opinion that they never will win a war.

The controversy as to whether air bombs can sink a modern battleship remains unsettled, but most of the evidence supports the negative view. Loyalist planes bombed the German "pocket battleship" *Deutschland* and killed twenty-three members of her crew, but didn't seriously damage the ship. Rebel planes scored direct hits with a ton of bombs on the loyalist's only battleship. Her superstructure was completely wrecked, but she didn't sink.

EVEN more surprising than the airplane's failure to live up to expectations has been the demonstrated efficiency of the antiaircraft gun. In the World War five out of every six airplanes brought down were the victims of other planes; in Spain five out of six of the planes brought down are accounted for by antiaircraft batteries. The 88-millimeter Bofors gun sent by the Germans to the Spanish test tube has been the outstanding surprise of the war. With an extreme vertical range of 30,000 feet, it is highly effective up to 20,000 feet, and it dominates the air to 12,000 feet. It is manufactured by a Swedish firm, and its performance has been so impressive that the British have outbid the Germans for the entire output—an indication that cold cash still is one of the most potent of war weapons!

Tanks have been improved tremendously since the British stunned the Germans by an attack with them before Cambrai in 1917. They are faster, more dependable, and somewhat less vulnerable to fire. But methods and weapons for fighting tanks have improved as fast as the tanks themselves, or faster, and there isn't the slightest indication that

these weird-looking mechanical monsters ever will fulfill the expectation that they would rule the battlefields of the future.

The Italians used them in Ethiopia, and the wild tribesmen were smart enough to "kill" them by setting fire to the heavy bush. The loyalists have used them in Spain, and the rebels have gone the Ethiopians one better. Their method is for two men to conceal themselves until a tank has passed, and then climb up on it. One of the men spurts gasoline into the monster's eye slits and ignites it. His partner waits until the tortured tank crew has to open the port at the top of the tank to keep from being burned to death—and then finishes it off with hand grenades. Not nice, but so effective that tank crews have been known to wreck their machines so that they wouldn't have to take them into action.

BOTH Russian and German tanks have been used in the Spanish fighting. Neither kind has proved satisfactory. A direct hit by a 75-millimeter shell will stop any tank under thirty tons. The Germans have a very fine 37-millimeter antitank gun that easily penetrates the heavy Russian tanks. And the failure of the light German tanks to stand up under machine-gun fire has made the German General Staff wonder if its four tank divisions of 250 tanks each haven't become obsolete before they have had a chance to do more than test the weapon.

Another dangerous enemy of the tank is the land mine, exploded by contact or electrically. A five-pound T.N.T. mine will put any tank out of action.

The British are the firmest believers in the usefulness of the tank. In addition to helping the advance of the infantry, they believe that it should be used—in conjunction with other armored vehicles—in place of cavalry. Such mechanized columns can move 100 miles

a day—for one day; then they have to devote a day to making repairs. This rate of advance seems revolutionary, until you remember that in our Civil War old Jeb Stuart's gray-coated cavalry rode eighty miles in twenty-four hours on its return from the Chambersburg raid, and then had enough strength and spirit left to charge and rout the Federal cavalry that tried to keep it from crossing the Potomac into Virginia.

One leading European military power, formerly a leader in mechanization, now is reported to be putting half its fast-moving forces back on horses as a result of observations made in the Ethiopian and Spanish campaigns.

JUDGING the tank by its performance in Spain, it is a valuable weapon under certain conditions—especially for counterattacking before the enemy can make defensive preparations—but not one that ever will do all that has been claimed for it.

It is fairly certain that no new weapon of major importance has been developed in the last twenty years. Gas has been used in Ethiopia and in Spain, but its effect never has been decisive. Electrical "death rays" and bacterial warfare remain—most fortunately—bad dreams of the horror writers. Chemists have worked overtime to produce an explosive more powerful than those used in the World War, but they haven't been able to beat T.N.T.

The "next war"—if it ever comes—won't be any better than the last one, but probably it won't be any worse. And perhaps there won't be any next war between powerful nations. Test-tube wars have proved to the military experts that there is no one weapon that can be depended upon to gain a quick decision. And that's a very good thing for the world, for the nations which would have to win quickly to win at all are the only nations that are likely to start a war.

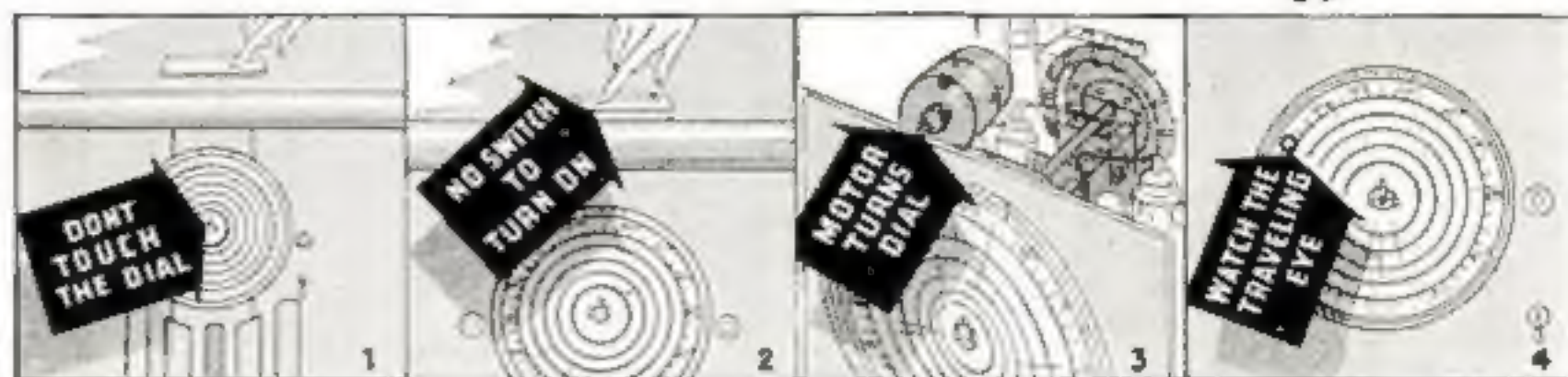
Farmer Grows Pumpkins with Human Faces



A mold shaped this pumpkin to the likeness of a human head

PUMPKINS with human faces have been produced by John M. Czeski, Ohio farmer, after four years of experimenting. To grow the novel fruit, Czeski fashions an aluminum mold of the head he wants to reproduce, and places it around a growing pumpkin approximately the size of a small grapefruit. After the pumpkin has expanded enough to fill the inside contours, the mold is removed. The print of the features remains as the pumpkin continues to grow, and the final result is a life-like full-size image in the ripened fruit.

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